Jummer

U. S. DEPARTMENT OF AGRICULTURE.

DIVISION OF ENTOMOLOGY.

PERIODICAL BULLETIN.

September, 1892, to July, 1893.

INSECT LIFE.

Vol. V.

DEVOTED TO THE ECONOMY AND LIFE-HABITS OF INSECTS, ESPECIALLY IN THEIR RELATIONS TO AGRICULTURE.

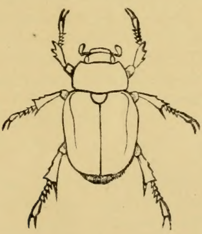
EDITED BY

C. V. RILEY, Entomologist,

AND

L. O. HOWARD, First Assistant,

WITH THE ASSISTANCE OF OTHER MEMBERS OF THE DIVISIONAL FORCE.



[PUBLISHED BY AUTHORITY OF THE SECRETARY OF AGRICULTURE.]

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1893.

TABLE OF CONTENTS.

CONTENTS OF No. 1.

CONTENTS OF NO. 2.

CONTENTS OF NO. 3.

CONTENTS OF NO. 4.

CONTENTS OF No. 5.

U. S. DEPARTMENT OF AGRICULTURE.

DIVISION OF ENTOMOLOGY.

PERIODICAL BULLETIN. Issued September, 1892.

Vol. V. No. 1.

INSECT LIFE.

DEVOTED TO THE ECONOMY AND LIFE-HABITS OF INSECTS, ESPECIALLY IN THEIR RELATIONS TO AGRICULTURE.

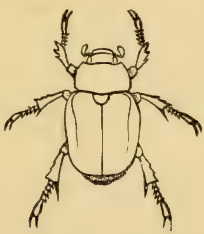
EDITED BY

C. V. RILEY, Entomologist,

AND

L. O. HOWARD, First Assistant,

WITH THE ASSISTANCE OF OTHER MEMBERS OF THE DIVISIONAL FORCE.



[PUBLISHED BY AUTHORITY OF THE SECRETARY OF AGRICULTURE.]

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1892.

CONTENTS.

SPECIAL NOTES.

The Agricultural Gazette of New South Wales.—Part 5 of volume 3, May, 1892, of this interesting journal contains Mr. Olliff's usual entomological notes. He treats in this number an insect which he calls Bronzy Orange Bug (*Oncoscelis sulciventris* Stoll). This insect seems to be a formidable pest in New South Wales, since it damages both fruit and the young shoots and buds by making innumerable punctures with its beak. The eggs are very large and laid in patches on the leaves or twigs. The number of annual generations is not given. The principal remedial work which has been done has been in jarring the bugs from the trees in the cool of the morning or on a cold, dull day, when the insects are more or less torpid. This species, in our opinion, could be readily destroyed by an application of kerosene emulsion. This is the same insect referred to by Mr. Koebele in his account of his trip to Australia in 1888 under the name of "*Aspongopus* sp." Mr. Olliff further treats of the subject of Codling Moth remedies, and reprints the striking experience of Mr. J. S. Lupton from INSECT LIFE. He urges the adoption of American methods.

Report of the Dominion Entomologist for 1891.—The annual report of the officers of the Experimental Farm system of the Dominion of Canada has just reached us in the shape of a royal octavo volume of 350 pages. Mr. James Fletcher's report as Entomologist and Botanist covers pages 192 to 220. The principal insects treated are the Eye-spotted Bud Moth, a new case-bearer of the Apple, the Pear-leaf Blister-mite, the Clover Root-borer, an oat weevil (*Macrops porcellus*), the Red Turnip Beetle (*Entomoscelis adonidis*), and the Pea Weevil. He also includes a section on spraying with the arsenites, in which he particularly reviews the London scare against American apples which attracted so much attention last fall. He gives the result of certain analyses by Mr. Shutt, the Chemist of the Dominion Experiment Farms, which indicated that not the slightest trace of arsenic could be found upon apples which were twice sprayed with Paris green during the month of June. In his Pea-weevil article Mr. Fletcher gives the result of some experiments in regard to the germination of peas which have been infested by the in-

sect, the results of which agree substantially with those of Prof. Popenoe, in Kansas, and to which we referred with some detail in Nos. 9 and 10 of the last volume. He also exposes the fallacy of the statement that weeviled peas can be detected by throwing the seed into water. The note upon the oat weevil is especially interesting, although the author states that the insect shows a greater preference for a wild grass (*Panicum crus-galli*) than for oats. He does not anticipate that it will ever become a serious pest. This species and *Entomoscelis adonidis* are here mentioned for the first time as injuring cultivated crops in this country. The latter is a circumpolar species, common to northern Europe and Asia, and occurs in Montana and Utah, as well as in the Northwest Territories and Manitoba. It was also destructive during the past season to radishes and cabbages.

Wheat Insects in Maryland.—Prof. Doran has published, as indicated in our foot-note,* a short illustrated account of the insects noticed as damaging the grain of wheat during his residence at the Maryland Agricultural College. The species treated are the Angoumois Grain-moth (*Gelechia cerealella*), the Red Grain-beetle (*Silvanus cassiæ*), the Lesser Grain-beetle (*S. surinamensis*), and the "Black Weevil" (*Calandra oryzæ*), the latter being more commonly known as the Rice Weevil. Prof. Doran has experimented with remedies against the Angoumois Grain-moth and finds that naphthaline is an admirable preventive. It acts more slowly than bisulphide of carbon, but its effects are more lasting. Bisulphide of carbon is recommended for the beetles, but in the only test made, the germination of wheat "was apparently affected unfavorably" by the treatment. An interesting observation on the rise in temperature of middlings infested by *Silvanus cassiæ* is mentioned, but the details of this curious fact will be given in full in No. 3, Vol. II, of the Proceedings of the Entomological Society of Washington.

The American Bot-flies whose Larvæ live in the Skin of Man.†—In a recent paper bearing this title Dr. Blanchard has given us a most valuable critical summary of the literature of the subject. He quotes verbatim the pertinent accounts of thirty-one authors, ranging from De La Condamine, 1749, to Gonnelle, 1889; compares carefully all of the larval descriptions, reproducing nearly all figures ever published, and arrives at the conclusion that four distinct species have been found infesting man.

---

*Bulletin No. 16 Maryland Agricultural Experiment Station. Insects injurious to the Grain of Wheat. By E. W. Doran, Ph. D., 1892.

† Sur les Œstrides américains dont la larve vit dans la Peau de l'Homme. Par le Dr. Raphael Blanchard. Extrait des Annales de la Société Entom. de France. Paris, 1892.

These four species he carefully describes from their larvæ, separating them by means of a synoptic table, but confesses himself unable to associate them with their adults, with the exception of the *Ver macaque*, which is undoubtedly *Dermatobia noxialis* Goudot. The second species, which he designates as *Torcel*, he believes to have been wrongly referred to *Dermatobia cyaniventris*. The third, designated as *Berne* or *Bicho Berne*, may be *D. cyaniventris*, but this the author states is pure presumption. The fourth, *Ver moyocuil*, is unknown in the perfect state.

The larvæ are distinguished as follows: The *Ver macaque* stands alone in having the second and third segments covered with very fine spinules. The *Berne* has the eighth segment with a row of anteverted spines on the dorsum. The *Torcel* has the third segment with a complete girdle of spines, while in the *Ver moyocuil* this girdle is lacking on the venter.

Fungicides and Insecticides.*—Bulletin No. 17 of the Hatch Experiment Station of Massachusetts is devoted largely to a report of experiments with fungicides, and with fungicides combined with insecticides. A number of expert fruit-growers took part in the experiments, spraying apparatus and chemicals being furnished them, in consideration of accurate work and full reports of results. The fungicides used were Bordeaux mixture, ammoniacal carbonate of copper, and the sulphates of copper and of iron. Paris green was the only insecticide used. The plants experimented upon were Apple, Pear, Plum, Peach, Grape, Potato, and Tomato. The life-histories of the principal fungi affecting the above are briefly given. The principal insects experimented against were the Codling Moth, Plum Curculio, and Tent Caterpillars.

A chapter devoted to the determination of the amount of copper on sprayed fruit, and which bears upon the absurd "grape scare" of last autumn, is of especial interest. Analyses were made to determine the actual quantity of copper adhering to grapes that had been sprayed with Bordeaux mixture. Analysis of the first sample, which was composed of grapes that had been badly disfigured by the fungicide, shows only two thousandths of 1 per cent of oxide of copper. To receive any injurious effects from such bunches of grapes, one would be obliged to eat something like a ton of them—stems, skins, and all. Sample No. 2 showed not even a trace of copper.

From the above it appears that with proper care in the application of the copper solutions, there will not be left even a trace of the copper on the fruit at the time of harvesting, while with the most careless use of the wash no harmful effects will accrue. The sensational account in the *London Pall Mall Gazette* of last autumn that American

---

* Hatch Experiment Station of the Massachusetts Agricultural College. Bulletin No. 17. Amherst, Mass., April, 1892, [pp. 47, pl. XI, figs. 4].

apples are poisoned with arsenic is referred to, and the determination of the quantity of copper and arsenic adhering to apples which had been sprayed three times with Bordeaux mixture and Paris green was undertaken with still more satisfactory results. The amount of oxide of copper was determined as about five ten-thousandths of an ounce to the barrel. No trace whatever of arsenic was found.

The conclusion reached as the results of the season's work in the use of Bordeaux mixture and Paris green on the plants previously mentioned is that the principal fungi are prevented, tent caterpillars and canker-worms are destroyed, and the injuries of the Codling Moth and Plum Curculio are largely prevented.

The bulletin concludes with instructions for the use of fungicides and insecticides.

Injurious Insects of South Africa.*—Four items of entomological interest are printed in this report. The Government viticulturist states that the Phylloxera is spreading at such a rate that there is little hope of its being eradicated. The methods that are being adopted are submersion and the cultivation of American vines. The former method has not yet been thoroughly tested, but the latter has thus far been successful. Mr. T. R. Sim contributes "Notes on two Insect Pests." The Fruit Moth (*Achæa chamæleon*) is a large species reported to be injurious to all soft fruits, and particularly peaches, by sucking out their juices. This is apparently a new pest in this locality, but the fruit trees were observed to be black with them and the damage done is said to be enormous. A species of ladybird, *Epilachna hirta*, has also done considerable damage in some districts to potatoes and tomatoes. As a remedy the writer makes the following recommendations: "Paris green applied as the Americans apply it for the Colorado Bug is a sure cure on potatoes, but is very poisonous and therefore not to be used on tomatoes." It might be stated, however, that the arsenite may be safely applied to tomatoes until after the plant blooms.

The same writer, in his report as curator of one of the local botanic gardens, states that *Icerya purchasi*, once a nuisance in the gardens, had almost entirely disappeared, having been attacked by a larva (species not stated) that destroyed it in its winter quarters, leaving nothing but the empty skins. Large colonies were thus destroyed.

An Entomological Bulletin from Washington.†—The first entomological bulletin which we have seen from our extreme Northwestern State has just reached us, bearing the title given in our foot-note. Mr. Scobey,

*Cape of Good Hope. Report of the Department of Agriculture for the year 1890–'91. Cape Town, 1891.

†Experiment Station, Pullman, Washington, Bull. 4, Wireworms, by J. O'B. Scobey, Agriculturist. Olympia, Wash., May, 1892.

the agriculturist of the station, gives a six-page illustrated account of *Melanotus communis* and *Agriotes mancus*, compiled mainly from Prof. Comstock's account of these species. Of the wire-worms damaging wheat the present spring in Garfield County, Mr. Scobey identifies 90 per cent as belonging to the former species and 10 per cent to the latter. We doubt the specific accuracy of these determinations, since up to the present time neither of these species has been found in the State of Washington.

Some Live-stock Pests in Louisiana.—In the report of the veterinarian of the Louisiana Agricultural Experiment Station for 1891 some attention is paid to the Horse-bot Fly, Screw-worm Fly, and to the Ox Warble. The notes are prepared from the remedial standpoint, and contain no new facts regarding the life-history. For the Horse Bot it is recommended to attend to the general health and condition of the animal by thorough grooming and cleanliness, and by improving his appetite and digestion by the use of some mineral or vegetable tonic, such as gentian, ginger, cinchona bark, or some of the salts of iron. Under the head of the Screw-worm Fly an interesting case is given, in which the Screw-worms rendered valuable assistance in removing a morbid growth in a hoof crack of a mule brought to the infirmary of the station for treatment. The worms removed the growth completely, and the veterinarian then removed the worms. Nothing is recommended for the Ox Warble except the application of tobacco juice and a two per-cent solution of carbolic acid, to prevent the deposition of the eggs.

Bulletin 30 of the South Dakota Station.—Messrs. I. H. Orcutt, Entomologist, and J. M. Aldrich, Assistant Entomologist, have just published a twenty-page bulletin, in which the new insectary is described, and short articles are given upon parasites of the large Willow Saw-fly; the food habits of the Striped Gopher; applying poison to potatoes; bee-keeping; soapsuds for cabbage lice; kerosene emulsion for lice on stock and for sheep scab; a cheap spraying pump, and general recommendations. Four Hymenopterous parasites are mentioned as affecting *Cimbex americana*, viz: *Cryptus nuncius*, *Opheltes glaucopterus*, *Limneria ferrugineipes*, and *Mesochorus melleus*. Four Dipterous insects are also mentioned as parasites, viz, one species of Sarcophaga and three of Phora. These, however, in our opinion, should not be considered as true parasites. The authors have concluded that a large proportion of the food of the Striped Gopher (*Spermophilus 13-lineatus*) consists of insects, and these are almost exclusively of injurious species, including principally cut-worms, web-worms and caterpillars. The authors advise the use of strong soapsuds upon cabbage for plant-lice in preference to kerosene emulsion, as they have found that a weak solution of the latter substance

does not kill the lice, while a strong solution injures the cabbages. The emulsion, however, is recommended for lice upon stock, while for sheep scab it is also a most excellent remedy. Under the head of general recommendations, remedies are given for the Willow Saw-fly, Cottonwood Leaf-beetle, Plant-lice, Cut-worms, Cecropia Moth, Tent Caterpillar, Ash Borer and Potato Beetle.

ROSE SAW-FLIES IN THE UNITED STATES.

By C. V. Riley.

THE BRISTLY ROSE-WORM.

(*Cladius pectinicornis* Fourcr.)

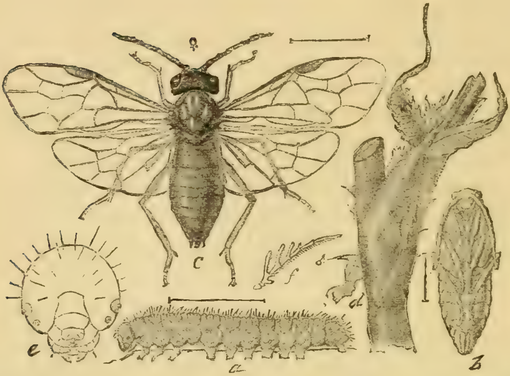


FIG. 1.—*Cladius pectinicornis*: *a*, larva; *b*, female pupa; *c*, female adult; *d*, cocoon; *e*, head of larva; *f*, antenna of male—all enlarged (original).

In 1880 I noticed that most of the leaves of the roses in my garden were badly eaten and mutilated, and, on examination, found that the insects which had been doing this damage were the larvæ of a saw-fly which differed from those of the common Rose Saw-fly (*Monostegia* [*Selandria*] *rosæ* Harris). They were watched until pupation, and the flies which emerged in spring proved to be identical with another of Harris's species, *Cladius isomera*,* which was redescribed by Norton in the Transactions of the American Entomological Society, Philadelphia, 1876, (pp. 74–75). Mr. Norton, at the end of his description, states that a number of the flies were taken by him June 29 on *Clematis virginiana*, near Farmington, Conn., without, however, intimating that this may be the food-plant of the species. Comparison of the description and speci-

*Harris, Catalogue. Norton, Boston Proc., VIII, 1881, 223.

mens of Harris's species with the European *Cladius pectinicornis* Fourcr.* proves the two species to be identical. The latter differs in fact in no important feature from, and has recorded of it the same larval characteristics and habits, as the American species. The old name *isomera* of Harris must give place to the name given by Fourcroy at a much earlier date. The introduction of this common European pest of the Rose doubtless took place at an early period. The hibernating larvæ at the base of the plants, or attached to the stems in their parchment-like cocoons, afford an easy method of introduction, and it would indeed have been remarkable if such introduction had not resulted.

Since the first discovery of the larvæ in 1880 the insect has persisted on my rose-bushes, and seems to have steadily increased in the city of Washington. It has also been found in other parts of the country. Its wide distribution and its rose-feeding habit are shown by the following records:

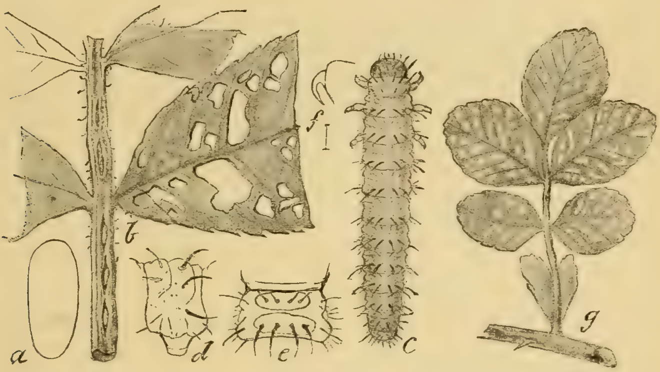


FIG. 2.—*Cladius pectinicornis*: *a*, egg; *b*, portion of leaf showing eggs *in situ* and work of young larvæ; *c*, newly-hatched larvæ; *d* and *e*, lateral and dorsal aspect of middle segment of same; *f*, larval claw; *g*, rose leaf showing nature of defoliation; all except *g* enlarged (original).

In May, 1886, a female of this species was discovered by Mr. F. M. Webster, at La Fayette, Ind., just in the act of oviposition, and in September, 1887, the larvæ were observed on some roses at Richfield Springs, N. Y.; while in the fall of 1889 Miss Murtfeldt found the larvæ at Kirkwood, Mo., and gave in Bulletin 22 of this Division a brief account of their habits.

Its mode of work is quite unlike that of the common Rose Saw-fly (*Monostegia rosæ*). Instead of feeding like that species, during its whole larval existence, exclusively upon the upper epidermis of the leaves, these larvæ while quite small feed upon the lower side only. Gradually, however, as they become larger, they eat irregular holes all

* Ent., Par. II, p. 374 (1788).

over the leaves, until often nothing remains but the stronger ribs. They are always concealed on the lower side, and are not readily noticed, even by an experienced eye, on account of their color, which harmonizes surprisingly with that of the leaves. Another characteristic of this species is, that, instead of descending to the ground to form their cocoons below the surface, as is the case with *M. rosæ*, the larvæ always form their rather delicate and more or less transparent cocoons in autumn in any suitable situation *above ground*, among fallen leaves and other rubbish, while during the warmer months they spin up on the lower side of the leaves or on the stems and branches of the plant upon which they have been feeding.

The first or spring brood of flies appears at Washington from the end of April until about the 20th of May, or even later. In the selection of suitable places for the insertion of her eggs the female again differs markedly from *M. rosæ*, for while this species oviposits under the cuticle of the leaf, as is common with many other species, our Cladius selects the upper side of the petiole of the leaves and inserts from one to three eggs, and sometimes more, close behind each other in an oblique slit made by the ovipositor. There are sometimes two or three such groups of eggs in one petiole. The first flies from hibernated cocoons issue as soon as the leaves put forth, and commence at once to oviposit. The eggs hatch in from a week to ten days, and the young larvæ begin feeding during the first week of May. Growth is rapid, and cocoons have been found by the middle of May. The pupa state lasts about fifteen days, so that the second brood of flies appears during the last days of May. At this time the latest larvæ have nearly attained their full growth. The second generation of worms begins work usually the second week in June, and from this time on, until quite late in Fall, larvæ of different stages may be found almost continuously, indicating that there are at least three and perhaps four annual generations, the last of the worms being found even as late as the first week in November. Nevertheless, during July there is comparative cessation of work between the second and third broods of worms, and fresh growth during this period is scarcely affected. The larvæ of the last brood, after having attained full growth, descend to the surface of the ground and spin up beneath any suitable object to pass the winter.

DESCRIPTIVE.

Cladius pectinicornis Fourcr. *Imago.*—Average expanse ♀ 10 mm, ♂ 9 mm. Color black, polished, sparsely and finely pilose. Ocelli red; eyes black and very finely facetted; behind each of the posterior ocelli there is a deep sinus, and a shallow basin inclosing the anterior ocellus. Antennal cavities of the head much excavated, so as to leave in front of the insertion of the antennæ a sharp median carina. Antennæ black; those of the male rather hairy, and with a rather long terminal branch on upper side of joints 3–5 and a very small, tooth-like projection at the end of the sixth. At the base of the lower side of the third there is a prominent, forward-curved, blunt process, while the apex of the third and seventh forms

an acute angle. Palpi black or dusky, the two terminal joints sometimes whitish. Femora black, their extreme tip, the tibiæ and tarsi yellow, the terminal joints of the tarsi and claws are more or less distinctly brown or dusky. In some females the yellow portions of the legs and tarsi are almost white. Tegulæ yellowish; cenchri whitish. Wings violaceous hyaline, sometimes yellowish or pale brownish. Stigma and veins black. Costa pale. The antennæ of the female are simple, quite stout; closely covered with short hairs, those of the two basal joints being somewhat longer and coarser. The lower edge of the third joint is slightly excised, whilst the fourth is slightly stoutish at the apex. On the upper side of the third and fifth there is a quite distinct, short, tooth-like projection.

Described from 17 males and 20 females.

Egg.—Length, 0.8 mm.; color, white. Somewhat flattened, rounded, and stoutest at the anterior end; more pointed at the opposite end.

Larva.—Length of full-grown larva, 16 mm.; diameter, 2.4 mm. Color somewhat variable, ranging from a dirty yellowish-green to a glaucous green; the medio-dorsal line slightly brownish in the paler and slightly darker green in the darker specimens. There may often be noticed a narrow, faintly whitish stigmatal line, and occasionally a rather broad, pale dusky, slightly oblique, subdorsal stripe on pro- and meso-thorax. Head, hairy, greenish-yellow, closely covered with minute, faintly elevated, more or less circular, flat, orange sculpturing, which gives to the head an orange appearance. Clypeus orange, its anterior third greenish, with a small blackish spot at each anterior angle; eyes black; mandibles black or brown at apex. The whole larva is quite bristly, especially at the sides. Each segment is divided by three transverse rows of transversely elongated, polished warts, each giving rise to a number of rather stiff, pale, glistening hairs, legs pale greenish-yellow; claws brownish at tip.

Pupa.—Color, grayish green; the thorax and end of body slightly yellowish; head, whitish-green; ocelli brown; eyes, black. Antennæ, wing-sheaths, and legs white with a slight green tinge.

Cocoon.—Length, 8–9 mm.; color, pale brown. Delicate, semitransparent, spun tightly to the lower surface of the leaves or other objects. It is generally surrounded by an irregular, ragged fringe, indicating a tendency to an additional external cocoon.

THE BANDED EMPHYTUS OR CURLED ROSE WORM.

(*Emphytus cinctus* L.)

In addition to the common Rose Slug (*Monostegia rosæ* Harris), and the species just described, there is a third saw-fly which breeds on the leaves of the Rose in parts of this country. I refer to the imported Rose Saw-fly (*Emphytus cinctus* L.), which was found by Mr. John G. Jack on the Rose at the Arnold Arboretum and in other botanic gardens in Boston and Cambridge. During the years 1887, 1888, and 1889, this insect was reported as being fully as injurious as the common Rose Slug. (See *Garden and Forest*, vol. III, p. 151, March 26, 1890.) Mr. Jack determined this as a European species which he thought to have been recently imported and probably in the stems of rose plants, in which the larva sometimes burrows to undergo its transformations or for winter hibernation, which habit also has led some European observers to consider this insect as a rose stem-borer rather than an external feeder. In the case of this insect again an American species has been characterized (*Emphytus cinctipes* Nort.) which cannot be distinguished, from the description, from the European species and which will un-

doubtedly prove to be identical with the latter. I have not seen authentic specimens of Norton's species, but there are no characters, indicated by Mr. Norton in his description, sufficient to separate the two species. Norton's specimens were collected in New England, but if they prove to be the same as the European species it would indicate that the species was imported very much earlier than Mr. Jack supposed. The European species is widely distributed, occurring throughout southern and central Europe and also in eastern Siberia, and is a well known rose pest, exactly agreeing in habit with the species described by Mr. Jack. Like the larvæ of *Cladius pectinicornis* the larva of this imported insect eats the entire substance of the leaf, but differs from the former in that it eats along the edges of the leaf with the body more or less beneath the leaf, and when at rest remains curled up on the under side of the leaf in a spiral or ball. The larva of the latter is easily distinguished also by being smooth and by having a yellowish-brown head with a broad brownish-black mark above. The body is dark green above, with the sides and legs grayish-white. There are several yearly broods, the larvæ appearing from May to October. The eggs are placed singly, but scattered to the number of three to seven, on the under sides of the leaves and the full-grown larva burrows, as stated, in the rotten wood or the pith of plants—very frequently of rose stems—to pupate or, in the case of the fall brood, to hibernate.

SUMMARY OF THE HABITS OF THE THREE SAW-FLIES AFFECTING ROSES IN THE UNITED STATES.

The following brief summary of the habits of the three species of saw-flies mentioned in the foregoing pages as affecting cultivated roses in this country will serve to enable anyone to distinguish the species and determine the depredator in any particular case.

THE AMERICAN ROSE SLUG (*Monostegia rosæ*).—This is the old and well known species, and the only one which, up to within the last few years, has been recorded as affecting the Rose in this country. It was originally found in the Eastern States, but has now become widely distributed by being transported from place to place in connection with rose plants. It is single brooded, the flies emerging in May, or about the time the Rose is in full leaf. The eggs are circular and are inserted singly in the edge of the leaf, on the under surface. The larva is about one-third of an inch long, and slug-like, the thorax being swollen; but it is not slimy, as is the case with many other allied saw-fly larvæ. It feeds only at night, and always on the upper side of the leaf, skeletonizing it rather than eating the entire substance. During the day it remains at rest, concealed on the under surface of the leaf.

The larval period lasts from fourteen to fifteen days, when the larva abandons the damaged plant and enters the soil, where it constructs a fragile earthen cocoon. In this it remains dormant until the following

spring, transforming to pupa shortly before the emergence of the adult insect in May. The appearance of the adult insects is somewhat irregular, and hence the larvæ are found on rose-bushes over a period of five or six weeks.

THE BRISTLY ROSE WORM (*Cladius pectinicornis*).—This insect produces three, or in some cases, four broods annually. The eggs are inserted in the upper side of the petiole of the leaf, and are placed in rows close behind each other, three or more together. The full-grown larva attains a length of 16 mm., and ranges in color from dirty yellowish-green to a glaucous-green with a dorsal line of a slightly darker green. The head is greenish-yellow and is covered with orange sculpturing. The whole larva is sparsely covered with stiff hairs or bristles, especially at the side. When quite young it skeletonizes the leaves, leaving whitish blotches, but as it grows older it devours irregular holes all over the leaf, eating the entire substance, until frequently nothing is left but the stronger ribs, the larva remaining all the time concealed on the under side of the leaf.

When full-fed it does not leave the plant, at least in the case of the earlier broods, but forms its cocoon, which is composed half of silk, half of some glutinous substance intermixed, and is spun tightly to the lower surface of the leaves or other objects, usually surrounded by an irregular fringe. The fall brood spins up among fallen leaves and other rubbish at the base of the bushes.

THE COILED ROSE WORM (*Emphytus cinctus*).—This insect is double-brooded, and in southern latitudes produces a third brood, the appearance of the worms extending from May to October. The eggs are placed singly to the number of from three to seven on the under surface of the leaves. The larva is easily distinguished from either of the other two by being smooth and by having its yellowish-brown head marked with a broad, brownish-black spot. The body is nearly linear, the under part swollen at the anterior extremity, and is dark-green above, with the sides and legs grayish-white. On reaching full growth, the larvæ bore into the pith of stems of dead rose branches or other plants, in which they pupate, or, in the case of the fall brood, hibernate. The larva eats the entire substance of the leaf, feeding along the edges with the body curled beneath it, and when at rest it remains curled up in a ball on the under surface of the leaf.

REMEDIES.

All three of these species are amenable to the ordinary remedy for saw-fly larvæ, viz, the application of powdered hellebore in water spray. A mixture of two ounces of hellebore to two or three gallons of water will be of sufficient strength to effect the destruction of the larvæ. In the case of the two newer species, *Cladius pectinicornis* and *Emphytus cinctus*, thorough treatment of the first will prevent the reappearance of the later broods, and very frequently hand-picking will be sufficient to check the insects, if carefully done in the case of the first brood.

AN EXPERIMENT AGAINST MOSQUITOES.*

By L. O. Howard.

One of the most reasonable of the recommendations which have been made from time to time, and which look toward the reduction of the mosquito plague during the summer months, is the application of kerosene to restricted and fishless breeding ponds. Although this remedy has often been suggested, I know of no careful records of actual experiments, and consequently deem the following account of a recent experience worthy of publication.

On the 5th of July of the present year I noticed for the first time a few mosquitoes on the porch of my cottage, in the Catskill Mountains of New York. The elevation of this cottage is about 2,500 feet, and mosquitoes have hitherto been rare visitors. The month of June, however, was very wet, and as I had noticed several pools of surface water in the immediate vicinity, the presence of these mosquitoes caused me some anxiety, as I feared they would continue to breed throughout the summer and prove a serious annoyance later in the season. One of the surface pools mentioned was situated upon my own grounds, and upon first noticing the mosquitoes I walked out to this spot. It was about dusk, and a dozen or more female mosquitoes were found buzzing about the surface of the water. I immediately sprinkled four ounces of coal oil upon the surface of the pond.

Upon the following day I carefully measured the little pool and found that it contained 60 square feet. From day to day until July 15, when I returned to Washington, observations were made. Severe rainstorms occurred on the 8th and 10th of the month, and after the first of these the pool lost the glassy iridescent surface effect given by the almost continuous but infinitesimally thin layer of kerosene. Nevertheless the insecticidal effect of the latter did not seem to diminish, although I could no longer perceive any coal-oil odor. Many dead insects were found floating upon the surface of the water the next morning after the application, and these increased rapidly up to the time of my departure. The pool, which upon the evening of the 5th had been teeming with animal life, contained no living insects during the following ten days.

The actual good accomplished is shown by the following facts: All aquatic larvæ, including those of the mosquito, were killed. The kerosene, curiously enough, seemed to exercise no deterrent effect upon the adult female mosquitoes. They still continued to attempt to deposit eggs and in this attempt were destroyed. This is, in my opinion, a most important point, and one which has hardly been anticipated.

On the tenth day after the application a careful count of the dead

* Read before the meeting of the Association of Economic Entomologists at Rochester, N. Y., August 16, 1892.

insects floating upon the surface of the water was made over a restricted portion, and from this count the entire insect surface contents of the pool was estimated, with the following result:

Entire number of dead insects floating on the surface	7,400
Number of mosquitoes	370
Number of *Epirrita inclinata* Walker—a small Geometrid moth	148
Number of *Heterophleps triguttata* H S.—another small Geometrid	42
Number of *Chrysops hilaris* O. S.—a common gad fly of the region	27

These were the most conspicuous. The others were mainly minute Nematocerous Diptera, although there were still a large number of small Heterocerous Lepidoptera, a few aquatic Coleoptera—the largest species being the Dytiscid *Agabus gagates* Aubé—and also a few specimens of Cryptocerate Heteroptera.

It is difficult to say how certain of the non-aquatic species, particularly the Lepidoptera and the Chrysops, happened to be caught. They may have visited the pool to drink or they may have been attracted to its shining surface.

The observation, it seems to me, possesses interest not only as proving definitely the efficacy of the remedy and as showing that adult mosquitoes are killed as well as their early stages, but also as affording an indication as to the amount of kerosene which will prove effective for a given surface of water, and also as affording some indication of the length of time for which a single application will be operative. It is true that upon this last point the observations were not complete, owing to my departure after ten days, but as already indicated, the influence of the kerosene outlasted all ocular or odorous evidence of its presence, and there is every reason to suppose that it would have continued for at least some days longer.

As a general thing, in larger ponds, which are of a more permanent character, the presence of fish is a check upon the multiplication of the mosquito. These insects breed mainly in marshy lands, where small pools, surrounded by wet soil, adjoin each other, and such spots, where accessible, can be readily and economically treated with coal oil. The economy of the operation is shown by a simple estimate from the data which I have given, that 5 gallons of coal oil, costing say 60 cents, will treat 9,600 square feet of water surface, or, to carry the computation still further, a barrel of kerosene, costing $4.50 will treat 96,000 square feet of water surface.

With this remedy and with the drainage of swamp lands where practicable, with the introduction of fish into ponds in which they do not already occur, and with the careful watching of rain-water barrels and tanks, the mosquito plague in many localities can be readily and greatly lessened. Where mosquitoes breed, however, in the long succession of brackish marshes on the seacoast, remedial work is practically hopeless. I anticipate not the slightest practical outcome from Mr. Robert H. Lamborn's dragon-fly proposition, and believe that relief in

such cases will only come from extensive improvements at the public expense in the way of the filling in and draining of the marshes.

One word more in reference to water tanks. The use of kerosene is of course out of the question in such receptacles. A note was published in INSECT LIFE (vol. IV, pp. 223–224) to the effect that the introduction of carp into water tanks in the Riviera was productive of the best results. This is a pertinent suggestion for trial in this country. The U. S. Fish Commission can doubtless furnish a limited number of carp for this purpose. All water tanks and barrels should, however, be tightly covered, and only opened occasionally for the purpose of aerating the water. When thrown open for this purpose it will not be difficult to ascertain whether larval mosquitoes (wrigglers) are present, and if so, and the tank is not too large, they can be removed by means of a fine-meshed hand net.

OCCURRENCE OF BUCCULATRIX CANADENSISELLA CHAMB. ON BIRCHES IN RHODE ISLAND.

By A. S. PACKARD, *Providence, R. I.*

My attention during the second week in September of last year was called to the widespread occurrence of the larvæ of this insect on the leaves of *Betula populifolia.* Over extensive tracts of woodlands and fields in east Providence and adjoining portions of Massachusetts, the leaves of birch shrubs and small trees had prematurely turned sere and brown, few healthy green leaves on a tree having been left.

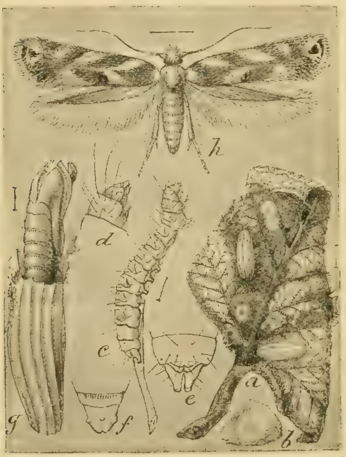


FIG. 3. *Bucculatrix canadensisella: a,* skeletonized birch leaf; *b,* pseudo-cocoon; *c,*larva; *d,* head of same; *e,* anal segments of same; *f,* anal segment of pupa; *g,* cocoon with extended pupa skin; *h,* moth—all enlarged (original).

The ravages of this worm seem to have attracted attention elsewhere, as an Attleboro correspondent of the *Providence Journal* for October 6 reported that almost every leaf of the White Birch in Bristol County, Mass., had been eaten by a worm; the account undoubtedly refers to this caterpillar.

This Tineid was first described, but without any information as to its habits, by the late Mr. V. T. Chambers, in the *Canadian Entomologist* for August, 1875 (vol. VII, p. 146). Some time ago Dr. J. A. Lintner wrote me regarding

the habits of this insect, kindly sending me his notes, in advance of publication in his annual report for that year.

This account has since been published in Dr. Lintner's Third Report as State Entomologist of New York, and is quoted in full in the Fifth Report of the U. S. Entomological Commission on Forest and Shade Tree Insects.

Mr. Shelby Reed, of Scottsville, Monroe County, N. Y., sends leaves of the Yellow Birch (*Betula lutea*), infested with small caterpillars, which are very numerous (forty-eight having been counted on a single leaf) and eat the upper and lower surfaces of the leaves, leaving only the transparent inner tissue. "The trees infested with them have a brown and scorched appearance, and light comes down through the thickest foliage as through a skylight. * * * A few of the larvæ had spun cocoons on the surface of the leaf when received. On the following day nearly all had made or were engaged in making their cocoons."

Our larvæ agree in all respects with Lintner's description.

The larvæ occur in great numbers, both on the upper and under side of the leaf, eating the parenchyma out of both sides, so as to skeletonize the leaf, which prematurely turns brown, many of them falling off. In confinement it walks slowly, often dropping down and hanging by a thread.

Larva.—Length 5 or 6 mm. The head is about two-thirds as wide as the body where thickest; it is pale honey-yellow. The body is long and slender, tapering regularly towards each extremity; the anal legs are rather large, project well behind the body, and diverge in creeping. The body is pale honey-yellow, with sometimes a slight greenish hue. The hairs are fine, scattered, arising from small pale warts; besides the four dorsal warts, which are arranged in a regular trapezoid, there is a lateral one visible on each side. The surface of the prothoracic segment is large and broad, though not so wide as the second thoracic segment; about six hairs project from the front edge. The segments are all very distinct, the sutures being deeply impressed, while the hinder edge of each segment is slightly raised and thickened. The second and third thoracic segments are much shorter than the prothoracic, while the first and seventh abdominal segments are longer, at least two-thirds, than the eighth. The ninth abdominal segment is much narrower than the eighth, and narrows posteriorly. There are four pairs of middle abdominal legs, and they are of the same color as the body. The oval cylindrical yellowish testes (?) are distinctly visible under the skin of the fifth abdominal segment.

Late in September and early in October the cocoons were found on the birch leaves, but also on those of the Wild Cherry. They are 5 mm. in length, and in shape elongated, oval, sharp at each end, and with eight sharp, high ridges. They are white, turning darker in many cases.

The moths had not, up to December 1, appeared in the tin boxes in which the cocoons had been kept in a warm room, but the chrysalids were alive, and will eventually, without doubt, give out the moths. It is evident that the enormous abundance of this Tineid is to be some-

what periodical, and though much harm is done, rendering the trees unsightly, it happens just before the falling of the leaves.*

NEW INJURIOUS INSECTS OF A YEAR.†

By C. V. Riley.

It is a common remark of members of this society, as well as of other horticultural societies, the meetings of which I have attended, that their insect enemies are on the increase. In one sense this is undoubtedly true, *i. e.*, the number of insects affecting our fruits as well as our other crops constantly grows as our knowledge of them becomes more and more complete; but I question whether more injury is done today to our fruits than was done fifty years or a hundred years ago. In fact, it is patent that with the advances made of late years in our methods of warfare against these fruit pests less injury relatively is done, but as the area of fruit culture increases so does the aggregate of injury and also the number of species that we have to contend with. It may convey to you some idea of the vastness of the subject of economic entomology for a country as great as ours to give a bare reference to the reports which have come to me within the year or since your last meeting, of insect injury, which is either quite novel or made by species that have hitherto been absolutely unknown.

A small mite, an undescribed species of Phytoptus, has been reported on Plum, making a gall on the leaf, from Akron, Ohio, and from Pompanoosuc, Vt.

A new plant-louse belonging to the genus Myzus was reported on Cherry from southern Indiana.

---

* September 14, 1886, we received a large number of larvæ of this insect on leaves of the Yellow Birch, most of which were completely skeletonized, from Mr. Shelby Reed, mentioned in Dr. Lintner's note cited above. Some of the larvæ had already spun their cocoons, and the moths began to issue January 26, 1887, and continued to make their appearance until March 3, 1887, twenty-seven in all issuing from this lot. September 13, 1890, we received similar skeletonized birch leaves with the same larvæ from Mr. F. M. Draper, East Norton, Mass., and, on September 15, others from Mr. William L. Tower, West Bridgewater, Mass. Mr. Draper said in his letter that the birches for miles around had been seriously attacked. The leaves were almost completely skeletonized from the under side, and had scattered over their surface numerous pseudo-cocoons of white silk, which contained the cast skin of the Bucculatrix larva, these seemingly having thus protected themselves during their molting periods. The true cocoons were spun a little later and were all of the usual oblong, longitudinally ribbed, yellowish appearance characteristic of this genus of Tineids. The moths issued, as with the specimens from New York, from the following January until March. A Chalcidid parasite of the genus *Derostenus* was reared from the New York specimens March 3, 1887. Judging from Mr. Draper's account, this insect bids fair to become a serious pest, and there seems little hope of being able to suggest any economical and effective remedy except in the case of isolated ornamental trees.—Eds. Insect Life.

† From a paper read before the American Pomological Society, September, 1891.

A leaf-folder (probably *Cacœcia argyrospila*) was reported on Apple and Gooseberry from Fort Collins and Denver, Colo.

A hairy caterpillar, undetermined, belonging to the genus Halisidota was reported on Apple from Highland, N. C.

Another hairy caterpillar belonging to the family Arctiidæ, but previously unobserved, was injurious to Mulberry, Pear, and Apple in Winchester, Mass.

A new species of plant-louse was badly infesting Orange leaves at Los Angeles, Cal.

An Allorhina, a large chafer belonging to the same family as the "rose bug," was quite injurious to fruits in Tombstone, Ariz.

An undescribed Aphis is reported on the Pear from La Fayette, Ind.

A species of Aleyrodes has been found on strawberry leaves in the District of Columbia, as also a new species of plant-louse.

Sparthocerus diffusus has been very injurious to grape leaves in Waldo, Fla.

A large scale-insect belonging to the genus Lecanium has been reported on strawberry leaves from Urbana, Ohio.

A new leaf-roller, belonging to the genus Semasia, was found on apple trees near St. Louis, Mo.

A new miner, belonging to the genus Lithocolletis, has been found in the epidermis of peach twigs in Napa County, Cal.

One of the fire-blight beetles (*Xyleborus dispar*), long known in Europe and in the eastern States to be injurious to certain fruit trees, was reported as quite injurious to various fruit trees in Nova Scotia.

A new span-worm has been reported on apple trees from La Fayette, Ind.

A flea-beetle (*Haltica ignita*) has proved very injurious to the Strawberry and Peach in Orlando, Fla., Lake City, Fla., Waco, Tex., and in Indiana.

A small mite, probably *Phytoptus pruni*, was injurious to Damson plum trees at Berlin Cross Roads, Ohio.

A little case-bearing Lepidopterous larva, belonging to the genus Coleophora, was injurious to the buds of peaches at Akron, Ohio.

A new species of the genus Lecanium was found affecting the twigs of plum trees at San José, Cal., and another species of the same genus was found on peach at Ithaca. N. Y.

Chrysochus cobaltinus was found injuring the leaves of young peach trees at San José, Cal.

An unknown Lepidopterous larva, one of the genus Hyphantria, was injurious to apple and some other trees at Omaha, Nebr., and Brownwood, Tex.

A bark-borer hitherto unknown to have such habits, viz, *Platypus compositus*, has been found boring in the trunks of orange trees in Lake County, Fla.

A new flat-headed borer has proved quite destructive to the Sharp-

less strawberry at Cœur d'Alene, Idaho. This is a rather remarkable fact, not only because the species of the family Buprestidæ, to which this flat-headed borer belongs, have hitherto been found boring under the bark of hardwood trees, but because the species belongs to an undescribed species of Chrysobothris, the same genus to which the Flat-headed Apple-tree Borer belongs, and one which has been recently monographed. In company with it there was an undescribed Lepidopterous crown-borer.

A saw-fly larva (*Janus flaviventris* Fitch) has been found in the stems of Currant at Adrian, Mich.

A case-bearer belonging to the genus Coleophora, also undescribed, was reported on orange trees from Los Angeles, Cal.

An undescribed mite of the genus Tetranychus, the same genus to which the Red Spider belongs, has been found on lemon trees at Los Angeles, Cal., as also an undescribed Thrips on orange trees in the same locality.

A leaf-hopper (*Typhlocyba rosæ*) has been very numerous on the leaves of apple trees at Burlington, Vt.

A canker-worm belonging to the genus Anisopteryx was reported on Plum from Elliott, Cal.

A snout-beetle (*Cercopeus chrysorhœus*) belonging to the same family as Fuller's Rose-beetle, and supposed to be the Grape Curculio, was found upon grapevine at Paris, Tex.

A currant-stem borer (*Oberea ocellata*) has been found breeding in the twigs of Peach in Harris County, Tex.

A new span-worm has been found feeding on the bark and young twigs of plum trees and doing considerable damage, at Mitchell, Ind.

A new case-bearer of the genus Coleophora was found on the buds of Blackberry in parts of Indiana.

A beetle larva, belonging to the family Tenebrionidæ and somewhat resembling a wire-worm, was very injurious to the roots of peach and plum trees in southern California.

An undescribed bug belonging to the genus Trapezonotus, has been very injurious to fruit trees in Lead County, Idaho, by sapping them.

A beetle (*Ptychodes trivittatus*) is reported as girdling the twigs of fig trees at New Orleans, La.

Another snout-beetle (*Thricolepis inornata*) was found injuring the foliage of young prune trees in Salem, Oregon.

A plant-louse, undeterminable, was badly infesting orange leaves at Santa Barbara, Cal.

A larva belonging to the same genus (Heliothis) as the Boll Worm was doing great damage to the leaves of apple and quince trees at Cœur d'Alene, Idaho.

An undetermined species of Lygus, one of the true bugs, was injuring young pears at South Byron, N. Y.

Fidia longipes and *F. murina*, two leaf-feeding beetles, were injurious to the leaves of grapevine at Vineland, Ark.

A flea-beetle (*Haltica foliacea*) was very injurious to grape foliage at Socorro, N. Mex.

A scale-insect (*Chionaspis biclavis*) was found on orange twigs in California, and in all probability was introduced from Tahiti.

Stictocephala inermis proved very injurious to young peach trees in Tehama County, Cal.

A new Icerya (the notorious Fluted Scale of California being the only species of the genus hitherto known in this country) was reported on Rose and other plants at Key West, Fla., and has been described as *I. rosæ.*

An undescribed scale-insect of the genus Lecanium was found infesting grape-vines at Hudson, Ohio, and in Pennsylvania.

I have thus enumerated the additions to the list of injurious insects that have incidentally come to the United States Department of Agriculture in this short period, and were I to enumerate those observed by myself and assistants, or recorded by other workers and other institutions the list would simply weary you.

NOTES ON THE LARVA OF AMPHIZOA.

By Henry G. Hubbard, *Detroit, Mich.*

In June, 1891, while on a collecting trip to Great Salt Lake and the mountains of Utah, Mr. E. A. Schwarz and the writer found *Amphizoa lecontei*, together with its larva, living in considerable numbers in a cold, clear mountain stream which supplies the city of Salt Lake with its drinking water. Other streams from the Wasatch Mountains emptying into the basin of Great Salt Lake produced the imago, and a single larva from American Fork Canyon presents differences which may be accidental. In May of the present year a single larva, indistinguishable from that of *A. lecontei*, was found at Glenwood Springs, Colo., at the junction of the Roaring Fork with the Grand River. A few weeks later the larva of *Amphizoa insolens*, with the imago, was found by Mr. Schwarz in the ice-cold waters of a mountain torrent at North Bend, in the Cascade Mountains of British Columbia. A careful comparison of the larvæ from British Columbia with those from Utah and Colorado fails to reveal any differences beyond the limits of individual variation and greater intensity of color and distinctness of markings in the

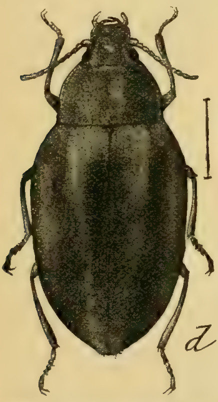


Fig. 4.—*Amphizoa lecontei*: adult, enlarged (original).

northern specimens. It is doubtful if any more valid distinction than this very common climatic variation exists between the two species of Amphizoa now in our catalogue. The form *josephi* has long ago been recognized as having no specific value.

The larva of Amphizoa (Fig. 5) is a short-legged, compactly built insect about three-quarters of an inch in length, of an umber-brown color varying to nearly black. The upper surface is convex and strongly chitinized, showing cloudy mottlings, which arrange themselves in longitudinal lines, and in dark specimens disappear, leaving several rows of translucent dots and dashes more or less sharply defined. The under surface is quite flat and naked. The dorsal shields entirely cover the upper surface of each segment and extend outward on the sides, forming explanate lobes. These lobes, evenly rounded on the throax, grow more and more acute posteriorly, and their outer margins give a remarkably regular fusiform outline to the body, which terminates acutely behind. The head is large and prominent, with a group of six

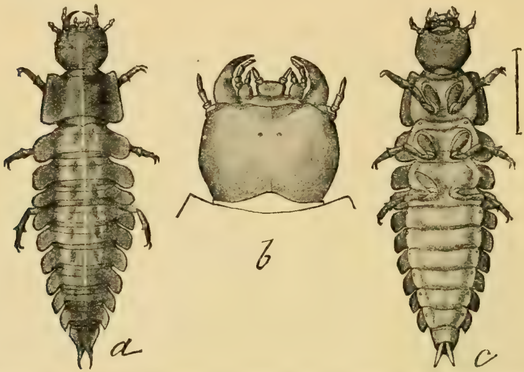


FIG. 5.—*Amphizoa lecontei:* larva, enlarged; *a*, dorsal view; *c*, ventral view; *b*, head, showing mouth-parts, much enlarged (original).

ocelli on each side near the front angles. The antennæ are short, three-jointed, placed just behind the jaws on the side margins. The jaws are deeply channeled within and armed with minute denticulations on the lower cutting edge. The buccal cavity is large, adapted to the mastication of food, and provided with molar plates formed by thickenings of the inner surface of the clypeus above and the mentum below. The maxillæ are stout, basal pieces surmounted by four-jointed palpi and the two-jointed inner lobes. The under lip is broadly transverse and prominent, without ligula, and with short, two-jointed palpi. The legs are widely separated, with six articulations, including the double claws. The abdomen consists of eight segments, and terminates in a pair of short movable spines which enter the eighth segment from

beneath, and are the only visible portions of the rudimentary ninth segment. The anal opening is a narrow slit between the bases of the terminal spines. The animal breathes by means of two large valvular spiracles placed close together at the tip of the eighth segment. Closed or rudimentary stigmata also occur on the mesothorax and on abdominal segments one to seven inclusive.*

The habits of the larva do not differ from those of the imago. Both live in shallow water or under partly submerged stones at the margins of streams. In City Canyon, Utah, larvæ and imago were found together clinging to floating sticks and willow catkins caught in an eddy of the stream. They were feeding apparently upon the drowned insects brought down by the water and lodged in the debris. When disturbed, they released their hold upon the floating fragments, and with outstretched legs sank helplessly to the bottom or were caught and borne away by the current. Although rather sluggish, they can crawl about actively under water, and soon regain the shore if carried beyond their depth.

The larva of Amphizoa presents affinities with widely separate groups of the Adephagous series of Coleoptera. The explanate, lobed margins of the dorsal shields and the broadly fusiform shape of the body exactly reproduce the general appearance of the larva of Cychrus. The number of the stigmata, structure of the mandibles, and form of the buccal cavity, together with its ambulatory habits, are likewise characters which tend to connect it with the Carabidæ, but the eight-jointed abdomen forbids its entrance into this family. On the other hand, the non-suctorial jaws effectively separate Amphizoa from the Dytiscidæ, although it has very many structural affinities with the water beetles, particularly with the tribe *Colymbitini*, for example in the position and structure of the antennæ, the form of the maxillæ and the lower lip, the terminal spiracles of the eighth segment and the cerci arising from a concealed ninth segment, the anal segment being also suppressed. Finally, with the European genus Pelobius, Amphizoa shares nearly all the distinctively Dytiscid characters which this genus possess. The larva of Pelobius is wholly aquatic and breathes by branchiæ, but the obsolete stigmata are indicated precisely as in Amphizoa, with the exception of the last pair, which in Amphizoa are open spiracles, but in Pelobius are suppressed; the terminal eighth segment being prolonged in a swimming stylet. The larva in both genera has non-suctorial jaws. Schiœdte's figure of the new-born larva of Pelobius, † with its enormously disproportionate, carapace-like head and general crustacean resemblance, suggests the suspicion that Am-

* A full description of the larvæ of *Amphizoa* has been presented before the Entomological Society of Washington at its meeting held May 4, 1892, and will be published in vol. II, No. 3, of the Proceedings.

† Kröyer's Naturh. Tidsskrift, vol. VIII, 1872, pl. V, Fig. 1.

phizoa also may have its "Nauplius" stage, and leave the egg as a swimming branchiate animal. Whether this surmise be true or false, the study of these larvæ leads irresistibly to the conclusion that Amphizoa and Pelobius are related ancient types, isolated by the extinction of surrounding forms and preserving synthetic resemblances to many existing families; the affinities of Amphizoa leaning towards the Carabidæ as those of Pelobius do towards the Dytiscidæ. The larval characteristics fully sustain the sound judgment of Dr. Horn in maintaining for Amphizoa its position as the type of a distinct family.

THE DIPTEROUS PARASITE OF MELANOPLUS DEVASTATOR IN CALIFORNIA.

By D. W. Coquillett, *Los Angeles, Cal.*

On the 22d of October, 1891, in a locality 10 miles from Los Angeles, while examining adult specimens of *Melanoplus devastator*, Scudder, in quest of internal parasites, I found in one of them a dipterous larva apparently nearly full grown. I then collected quite a large number of these locusts and brought them home with me, and the next day five larvæ issued from one of them and soon afterward pupated. The flies issued between the 10th and 13th of the following April. They belong to the old genus Sarcophaga, but I am unable to identify them with any of the published descriptions, and in the belief that the species is new, present the following description of it:

Sarcophaga opifera n. sp. ♂.—Front silvery-white pollinose, at narrowest point one-seventh width of head; frontal vitta brown, half as wide as front at narrowest point; the two posterior pairs of frontal bristles directed backward, the others decussate, reaching first third of second antennal joint; no orbital bristles; antennæ, dark brown, reaching three-fourths the distance to the oral margin; third joint scarcely longer than the second; arista black, two-jointed, basal joint as broad as long, the second joint thickened on its basal two-fifths, plumose on its basal two-thirds, bearing two long hairs on its lower side beyond the outermost one on its upper side. Face silvery-white pollinose, but in certain lights showing a brassy tinge; sides of face with a single row of bristles near the eye, those on sides of central depression ascending slightly above tip of antennæ; cheeks one-third height of eyes, densely bristly. Proboscis blackish, slightly shorter than height of head; palpi yellow-brown. Thorax light gray, usually marked with seven black stripes, but some of these are occasionally wanting; three pairs of subdorsal bristles behind the suture. Scutellum gray; a pair of small apical and a second pair of discal bristles, also two lateral pairs of much larger bristles. Abdomen gray, not distinctly checkered, marked with three black vittæ; each segment, except in middle of the dorsum of the first, with a marginal row of bristles; hind margin of the last segment and the genitalia yellow brown. Legs grayish black, all femora and tibiæ bristly; posterior tibiæ not bearded within; claws as long as the last tarsal joint. Tegula whitish-hyaline. Wings grayish-hyaline, base of third vein bristly half way to small cross-vein; other veins bare, first posterior cell open, ending some distance be-

fore apex of wing; elbow of fourth vein forming a right angle, not appendiculate; posterior cross-vein at last third of distance from small cross-vein to the elbow, slightly more transverse than the last half of the apical cross-vein, the latter bowed inward near its base; no costal spine.

♀ Differing from the ♂ as follows: Front nearly one-third width of head; frontal vitta one-third width of front; two pairs of orbital bristles; cheeks nearly one-half height of eyes; scutellum destitute of an apical pair of bristles; claws much shorter than in the ♂.

Length, 5 to 6^{mm}. Described from three males and two females.

The number of locusts infested by these parasites does not appear to be very large. In the locality where I observed them the locusts were quite numerous, and yet not more than 2 percent were infested with these parasites. I notice that in the September number of INSECT LIFE for 1889 (page 68), Mr. C. L. Marlatt states that in a certain locality in New Hampshire about 5 percent of the locusts examined by him contained Tachinid or Sarcophagid parasites.

Up to a comparatively recent date the different species of Sarcophaga were very generally supposed to feed in the larva state upon flesh, and for this reason were referred to as "Flesh-flies." And yet, curiously enough, among all the works which I have been able to consult upon this subject I have been unable to find a single recorded instance where a fly of this kind has ever been bred from flesh in this country. On the other hand, I find several instances on record where specimens of Sarcophaga have been bred from living insects.

The earliest case of this kind is that recorded by the late Abbé Provancher, who, in the second volume of *Le Naturaliste Canadien* (p. 18) records having bred a specimen of Sarcophaga from a chrysalis of the Cabbage Butterfly (*Pieris rapae* Schrank). In his Seventh Report on the Insects of Missouri (pp. 180–181), Prof. Riley records having bred a species of Sarcophaga from various kinds of locusts, as also from the Mantis (*Stagmomantis carolina* Burm.), and from the common Walking-stick (*Diapheromera femorata* Say); and in the Fourth Report of the U. S. Entomological Commission (p. 107), he states that a species of Sarcophaga infests the larvæ and chrysalides of the Cotton Moth (*Aletia xylina* Say). More recently Prof. Townsend has characterized, under the name of *Sarcophaga cimbicis*, a species bred by Mr. Aldrich from cocoons of the American Cimbex (*Cimbex americana* Leach; see the *Canadian Entomologist* for May, 1892, pp. 126–127). In foreign countries *Sarcophaga lineata* is reported to prey upon locusts in the vicinity of the Dardanelles, referred to on page 59 of Appendix VIII, Third Report of the U. S. Entomological Commission. And in the *Agricultural Gazette* for May, 1891, is given a figure and description of a two-winged fly which is stated to infest locusts in various parts of Australia; this fly is there referred to the Tachinidæ, and to the genus Masicera, but judging from the figure and description it clearly belongs to the Sarcophagidæ.

In order to give as far as possible a complete account of the known

habits of the Sarcophagidæ, I may add that in *Psyche* for February, 1892 (pp. 220–221), Prof. Townsend describes a *Sarcophaga helicis* as having been bred from a living snail by Mr. Surface. In his Seventh Report on the Insects of Missouri (p. 181), Prof. Riley states that the larvæ of *Sarcophaga sarraceniæ* feed upon dead insects, and in his Ninth Report (p. 95) he states that they also feed upon the eggs of locusts. A few days ago, Dr. A. Davidson, of this city, submitted to me two male specimens of an undescribed species of Sarcophaga which he had bred from larvæ found feeding upon the eggs of the spider, *Phidippus opifex* McCook. These flies differ from the above description of *Sarcophaga opifera* only in the following particulars:

Antennæ black, the third joint one and a half times as long as the second, arista plumose on its basal half, bearing one long hair on its upper side beyond the outermost long one on its lower side. Face with two irregular, widely separated rows of bristles each side. Palpi black. Hind margin of the fourth abdominal segment black, genitalia grayish black, the lower half polished black. Length 6½ to 8mm.

It may be named *Sarcophaga davidsonii* in honor of its discoverer. From the above observations it is very evident that in their habits the Sarcophagidæ are much more closely related to the Tachinidæ than is commonly supposed to be the case.

A NEW SWEET POTATO SAW-FLY.

(*Schizocerus privatus* Norton.)

By C. L. MARLATT.

In the first volume of INSECT LIFE (pp. 43–45) an illustrated account was given of a rather rare saw-fly (*Schizocerus ebenus* Norton) which had suddenly appeared in very destructive numbers in the summer of 1886–'87, attacking and nearly destroying the sweet potato crop of Mr. C. Werkle, of Ocean Springs, Miss. Injury to the sweet potato from this insect has not again been brought to my attention. A year ago, however, attention was drawn to injury by the larvæ of a saw-fly to the sweet potato crop in Virginia by the receipt, July 6, 1891, from Mr. G. W. Stockley, of Keller, Accomac County, of specimens of the young larvæ, together with one male and three female flies. (See Extracts from Correspondence, INSECT LIFE, vol. IV, p. 74.) The specimens were turned over to me by Prof. Riley for study and report.

Examination of the adults showed that they belonged to a distinct species, but one closely allied to the one mentioned above. This new sweet potato pest belongs to the same genus as the former, and was originally described as *Schizocerus privatus* by Mr. Edw. Norton from

a single female specimen collected at New Orleans, La. (June, 1867, Trans. Am. Ent. Soc., p. 26.)

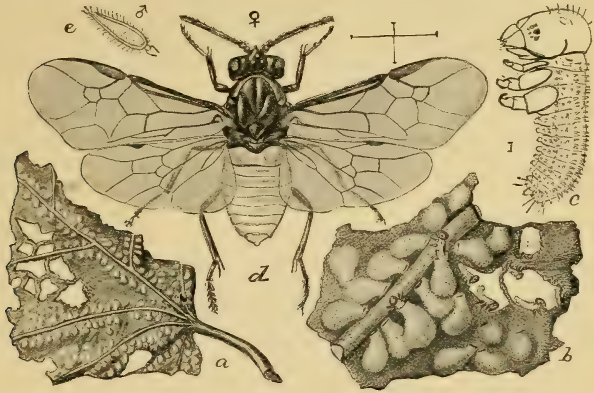


FIG. 6.—*Schizocerus privatus:* *a*, portion of leaf showing arrangement and appearance of egg-sacs; *b*, portion of same more enlarged, with escaping larvæ; *c*, newly-hatched larvæ; *d*, female fly, *e*, antenna of male; all enlarged except *a* (original).

The insect has hitherto been a very rare one, and in fact the male of it has never been described. In a collection of Tenthredinidæ, recently received at the Department for determination from the Michigan Agricultural College, were a number of specimens of both sexes of this species, taken in Michigan; and there is a specimen, bearing the locality label "Nebraska," in the collection of the American Entomological Society of Philadelphia.

The female (Fig. 6 *d*) is nearly twice the size of the common house-fly, and is shining black, including the legs, except the basal joints (coxæ and trochanters) of the hind pairs; the abdomen is reddish yellow, including also the lateral and ventral portion of the metathorax. The wings are very smoky, almost opaque. The antennæ of the female is simple and consists of three joints, of which the last is very long; in the male this last joint is bifurcate, as shown at *e*. The male is also considerably smaller than the female, and differs from the latter still further in being entirely black except the legs, which are whitish in part. In coloration this species is almost identical with *S. ebenus*, except that in general the colors are brighter and more sharply defined in the former. The female is, however, more than twice the size of the latter species and much more robust, which differences also hold true, but to a less extent, in the case of the males of the two species. Other important differences may be noted as follows:

As compared with *ebenus*, the head of *privatus* is much less trilobate when viewed from above; the antennæ of the female are more filiform

and the forked joint in the males is relatively shorter. The two species differ also somewhat in venation. With *privatus* the costal and sub-costal veins are very broad, very much reducing or almost obliterating the costal cell, which in *ebenus* is of ample proportions. The third sub-marginal cell is in the former species considerably widened above on the side of the radial nervure, and the third transverso-cubital nervure, which forms the outer border of this cell, is decidedly curved outward, whereas in the latter species the inner and outer bordering nervures are nearly straight and parallel. The under middle cell of the hind wings, also in *privatus*, is only about one-third the length of the upper, while in *ebenus* this cell is at least one-half the length of the upper cell.

In the male of *ebenus* the tibiæ and tarsi are smoky white, the two posterior pairs being darker; in *privatus* these parts are much lighter, almost pure white, except that the tip of the posterior tibiæ is distinctly dusky together with the extremities of all the tarsi.

Mr. Stockley's letter relating to this insect has already been published, but is here reproduced:

> I have sent you by today's mail a box containing some flies and their eggs on some sweet potato leaves. Last year was the first time they made their appearance in my potato patch. They came the 1st of July and deposited their eggs on the eaves; when the eggs hatched these worms would eat the leaves to a comb. This continued for about four weeks. The potatoes, wherever the fly was, did not make any yield at all. This year the fly made its appearance at the same time they did last year. Will you please tell me what kind of a fly it is and whether it will do any serious damage?

The deposition of the eggs in the under side of the leaf by the female fly is shown, natural size, at *a*. It will be seen that they are placed for the most part in parallel rows bordering the principal veins, the incisions of the ovipositor being next to the veins. When first deposited the position of the egg is shown by a circular or oval blister, at one side of which is the discolored slit in the epidermis made in inserting the egg. As is the case with saw-flies generally the egg expands considerably before the hatching of the larva—increasing the prominence of the blister-like spot—and on the emergence of the young larva through the slit left by the ovipositor the blister is lengthened and gives the pouch-like or guttiform appearance shown enlarged at *b*.

None but young larvæ were received, and these, together with the other material, were dried and no opportunity offered to obtain the later stages.

The larvæ closely resemble those of *ebenus*, figured in the article cited on that species, both in general appearance and in the disposition of the spines on the body. A newly-hatched larva is shown in outline at *c*.

A single cocoon of this saw-fly was received, from which a very handsome Tachinid parasite was reared. The cocoon is about five-sixteenths

of an inch long, oval, and is constructed of a loose mesh of a brownish silky or glutinous material.

I hope another year to get additional material and complete the study of the biology of this interesting insect or that this fragmentary account of it may lead others more favorably situated to supply the facts now lacking in relation to the later larval stages and hibernation.

Prompt application of the arsenicals will doubtless be an effective remedy for this insect, though judging from analogy, hellebore will also prove effective, and, other things being equal, preferable.

ON THE NOMENCLATURE AND ON THE OVIPOSITION OF THE BEAN WEEVIL.

(*Bruchus obtectus* Say.)

In double number 9 and 10 of the last volume of INSECT LIFE (pp. 297 to 302) we published editorially a popular article upon the Bean and Pea Weevils, referring to the former under our old name of *Bruchus fabæ* Riley, promising, however, in a foot-note to discuss the question of synonymy in a succeeding number of this publication.

At the time (1870) when we originally proposed the new name of *Bruchus fabæ* in our Third Report on the Insects of Missouri (p. 55) we paid considerable attention to the matter of its validity as a species. Up to that time the weevil bred commonly from cultivated beans had been considered by most coleopterists, following the authority of Dr. George H. Horn, to be identical with Say's *Bruchus obsoletus*. We showed that it differed from *obsoletus* in the following points:

Obsoletus is a smaller species, dark gray, with the antennæ all dark, the pygidium not rufous, the thorax with a perceptibly darker dorsal shade so that the sides appear more cinereous, a white scutel, and each interstitial line of the elytra with a slight appearance of alternating whitish and dusky along its whole length; for though there is nothing in Say's language to indicate whether it is the interstitial lines that alternate transversely, whitish and dusky, or each line that so alternates longitudinally, I find from an examination of a specimen in the Walsh collection that the latter is the case, and so much so that the insect almost appears speckled. The two species differ both in size and color, though, as Say's description is short and imperfect, it is not surprising that *fabæ* should have been referred to it.

Prior to the time of our description the Bean Weevil had been for several years labeled in eastern insect collections "*Bruchus fabæ*," and this name was disseminated by F. G. Sanborn and credited to Fabricius. We could find no notice of the species in any of the writings of Fabricius and for that reason adopted the eminently appropriate name *fabæ* for our own.

In 1872 we were informed that Dr. Fitch had described the Bean

Weevil under the same name *Bruchus fabæ*, and wrote him under date February 4, 1872, as follows:

I have been expecting a fulfilment of your promise to write to me. I am especially anxious to make the proper corrections as to the nomenclature of *Bruchus fabæ*, in my forthcoming report; but can not well do so until I receive from you the paper in which you originally described it under that name or a copy of it. Can you not send it?

This, however, was toward the end of the working career of the celebrated New York State Entomologist, and we received no reply.

Eighteen years later Mr. Scudder bought Fitch's manuscript notes from Dr. A. E. Foote, of Philadelphia, and gave them to the Boston Society of Natural History. Mr. Samuel Henshaw, the Assistant Curator of the Society, began arranging them somewhat after the manner of the Harris manuscript, and among the note-books found our letter just quoted. He found, moreover, notes by Fitch bearing upon the point, and was kind enough to copy them and send them to us (October 7, 1890) as the first reference he had seen to *Bruchus fabæ* Fitch. We give the transcript from Fitch's notes:

In August, 1860, I received from W. R. Staples, secretary of the Rhode Island Society for the Encouragement of Domestic Industry, a small parcel of beans infested by insects, the result of my examination of which I communicated to him in the following letter, which was published in the Transactions of the Society for that year, page 62, this volume having been issued in February, 1861.

He stated in the accompanying communication that the stored beans in the city of Providence were quite generally preyed upon by this insect. I subsequently learned it was common in and around the city of New York and other places along the seaboard, and from complaints made by prisoners in the late civil war of the wormy beans furnished them for food, and which were so loathsome to them, I infer this insect to be common through the Southern States. Mr. Riley having received specimens from Massachusetts ticketed as being the *Bruchus fabæ* of Fab., and finding no such name in the works of Fab., described it as a new species under this name in his Third Report, page 52 [*sic*]:

The confusion regarding the existence of a *Bruchus fabæ* Fab. is further explained in Dr. Fitch's notes as follows, the "Boston entomologist" being probably Mr. F. G. Sanborn referred to above:

Specimens were sent from Rhode Island in 1862 to the Boston Entomologist, probably ticketed "*Bruchus fabæ* Fh." The abbreviation was no doubt misread "Fb," and thus this has become common in the collections as a Fabrician species. Mr. Riley, finding Fabricius had described no species under this name, gives it as a new species in his Third Report, page 55. What is here presented will clear this matter of the misapprehensions which have been so widely prevalent.

Fitch's conclusion in regard to the matter is undoubtedly correct. The misapprehension was a most natural one, but fortunately the confusion arising therefrom was not very great. Mr. Henshaw also forwarded to us a proof slip (also found among Fitch's notes) of Fitch's letter to the secretary of the Rhode Island Society for the Encouragement of Domestic Industry, giving his description of the Bean Weevil under the name of *Bruchus fabæ*.

We append for wider circulation a copy of Fitch's published letter previously referred to.

W. R. STAPLES:

Secretary of the Rhode Island Society for the Encouragement of Domestic Industry:

DEAR SIR: Whoever inspects beans infested with the insect which you send me will at once infer that this depredator is closely akin to the well-known Pea-bug, or Pea weevil, as it might better be called—the *Bruchus pisi* of Linnæus—the beans being perforated with large round holes, similar to those in the pea, where the insect has escaped, or presenting a discolored spot, under which is a round cavity, in which the creature is still lying; the only important difference being, that as the bean is a much larger fruit, several holes, usually as many as six and sometimes twelve, are bored in it, instead of the single hole which we see in peas. And on inspecting this insect, I find it to be a weevil so similar in its general appearance to that of the pea that persons who have not made this class of animals a special study would probably infer it to be the very same insect, somewhat modified in consequence of its being reared upon slightly different food. But on close inspection, it will be found to differ essentially from that insect, in many points of its structure and colors.

From the examination I am at present to make, I do not recognize this as a species that has been heretofore described. I infer it has but recently been noticed in your vicinity, and it would hence appear to have been introduced, probably, from some foreign country. It, however, is unlike the *Bruchus rufimanus* and *granarius* common insects in Southern Europe, which prey upon beans in this same manner. In addition to these, I see a Brazilian species has been named *B. phaseoli* by M. Chevrolat, a name implying it to subsist on the bean, but I have not the work of this author at hand. Upon a kind of wild bean growing in Indiana, Mr. Say met with a beetle which he names *B. obscurus*, which appears to approach nearer to this insect than does any other species to which I can refer. Under the circumstances, the best service I can render will be to present a name for this insect, with such a description of it as will serve to plainly distinguish it, and thus open the way for future researches to determine whether it really is a species which has lurked unnoticed in the world until the present time. I would therefore name it the Bean-weevil (*Bruchus fabæ*). It is slightly smaller than our pea-weevil, its length being from $\frac{13}{100}$ to $\frac{15}{100}$ of an inch. It is of a black color, more or less densely coated over with tarnished yellowish gray pubescence, and is particularly distinguished from other species by having the four first and last joints of its antennæ, and all its legs, of a rusty or pale dull yellowish color, with only the under side of the hind thighs black. Along the middle of its thorax is a faint whitish stripe, which has an impressed line at its hind end. Its wing-covers have impressed lines or striæ, the interstices between which are alternately of a faint whitish color, this color, being most clear and distinct along the middle of the third interstice between two faint blackish spots, which are placed on this interstice, a few other blackish spots being also perceptible here and there, outside of this. The abdomen or hind body is pale dull yellow, with a black band on the fore part of each joint, and its flattened tip, beyond the ends of the wing-covers, is obscure grayish, with a faint whitish stripe along its middle. On the under side of the hind thighs, near their end, is a little projecting spine, like the point of a thorn, with a similar very minute one at its hind base, followed by a more minute, blunt-pointed one.

The habits and transformations of this insect will probably be found to vary but little from those of the pea-weevil; and the same remedies doubtless will be as efficacious against the one as the other. It is generally known that the Pea-weevil rarely injures the embryo or germ of the future sprout, and that "buggy peas" may consequently be used for seed; though the plants from them will probably be puny and feeble during the first stages of their growth. This Bean-weevil is a more invet-

erate enemy, for in most instances I find the germ is devoured, rendering the beans as worthless for seed as they are for food.

We have for some time intended to discuss this matter in print, but in the meantime Dr. Lintner in his Seventh Report on the Insects of New York has gone quite fully into the matter in his usual thorough and characteristic manner, and has republished Fitch's letter to the secretary of the society above mentioned.

Dr. Lintner doubts the propriety of adopting Say's names for this Bean Weevil, and although he writes, under protest, Say's name *obsoletus* at the head of his article, thus following the nomenclature presented in Dr. Horn's Revision of the Bruchidæ, he is nevertheless of the opinion that custom, and even the rules of nomenclature, would justify us in writing *Bruchus fabæ* Fitch. We are so fully in accord with his views that we quote the following paragraph:

It would better accord with custom and rules of nomenclature if, instead of clinging pertinaciously to Say's name in the belief that we know the insect to which it was applied, that it be rejected on the ground of its having been accompanied with merely a definition—without description such as leaves no room for reasonable doubt. Such rejection has been repeatedly made, as notably with scores of Walker's "species." In that event—as the description of Dr. Fitch unmistakably indicates our Bean Weevil, and as it has priority of and fully accords with the *varicornis* of LeConte, the *fabæ* of Riley, and the *obsoletus* of Horn—"*obsoletus* Say" would give place to *fabæ* Fitch.

The reasons which we gave in 1871 for considering the Bean Weevil distinct from *obsoletus* seem to us as good to-day as they did then, and we have since obtained substantial indirect evidence against Dr. Horn's claim. Say mentions having found *obsoletus* on a species of Astragalus from which he also obtained *Apion segnipes*. We have always believed that *obsoletus* would be rediscovered, and have for years sought to ascertain more of the food plants of our Bruchidæ. Now in Mr. Schwarz's collection we have a Bruchus in connection with this very *Apion segnipes* on *Tephrosia virginiana* near Washington, and this Bruchus agrees in size and all other characteristics fully with Say's description of *obsoletus*, and further corresponds, as we distinctly recollect, with the specimen thus marked which we referred to as having seen in Walsh's old collection, thus indicating that the species occurs likewise in the Mississippi Valley. With all due respect to authority, therefore, we think that the case against our Bean Weevil being *obsoletus* is sufficiently made out, and that we must not follow Dr. Horn in his rather arbitrary conclusion. In point of fact, as all who have gone over the descriptions carefully will admit, *obtectus* Say, which precedes *obsoletus* in the descriptions, is more plainly referable to our Bean Weevil. Under the strict law of priority, therefore, our Bean Weevil should be written *Bruchus obtectus* Say.

In reference to the European nomenclature of our Bean Weevil, Baudi, in his monograph of the European Bruchidæ (Deutsch. Ent.

Zeit. XXXI, 1887, p. 48) doubtless has some good reason (such as the examination of original types) for identifying *obtectus* Say as *irresectus* Fahræus. But we can not see that he has any good reason for giving it precedence in time over Say's name. On the contrary, chronologically, the synonymy of the species would in our judgment stand thus:

1831—Bruchus obtectus Say.
1833—Bruchus leguminarius (Chevrolat) Gyll.
1839—Bruchus irresectus (Schönherr) Fahræus.
1839—Bruchus pallidipes (Chevrolat) Fahræus.
1854—Bruchus subellipticus Wollaston.
1861—Bruchus fabæ Fitch.
1867—Bruchus breweri Crotch.
1871—Bruchus fabæ Riley.
1873—Bruchus obsoletus (Say) Horn.
1889—Bruchus subarmatus Janson (?=subarmatus Gyll.).

Bruchus varicornis Lec. is a manuscript name; *B. obscurus* (Say) Fitch is a *lapsus calami* for *obsoletus* Say; while *B. acupunctus* Chevr. appears to be a mere label or manuscript name. Baudi (*l. c.*, p. 49) indicates that *irresectus* is labeled in the Turin Royal Museum as (*Mylabris*) *acupuncta* Chevr. from Louisiana, and that a second specimen is also labeled (*M.*) *leguminaria* Chevr., this last probably sent by Chevrolat himself. Thus, aside from the fact that the description of *leguminarius* tallies very well with our Bean Weevil, we have this identification by Baudi.

To sum up the question of nomenclature, our Bean Weevil, on the strict law of priority, must be known as *Bruchus obtectus* Say until someone shall resurrect some hitherto unrecognized and earlier published name that can be proved to refer to it.

It is a widely distributed species, according to the authorities, having been reported from Central and South America, Madeira, Canaries, Mediterranean countries, the Alps, western France, Spain, Persia, etc. It is doubtless cosmopolitan, like so many species carried by commerce in stored products, and its wide distribution and the early European references to it really make it questionable whether it is to be considered any longer as a native American species. This question acquires an additional interest from the consideration that if it were once determined not to be an indigene it is improbable that Say would have found it on any wild leguminous plant.

OVIPOSITION IN THE FIELD.

Notwithstanding the wide distribution of the species it is only during the present year that its habits in the field have been in any way carefully studied. It is not necessary in this connection to repeat anything in reference to the oviposition of the species in stored beans, as we have fully described the method and the eggs on page 300 of vol. IV, INSECT LIFE. We realized, however, that more careful observations were needed as to the habits of the species in the field, as we have for

some time doubted whether the eggs found on bean pods were really those of this species. It has been currently stated that the eggs are laid on the bean pods something as in the case of the Pea Weevil, and it is true that eggs are found upon bean pods fastened very much as those of *Bruchus pisi* are fastened to pea pods; but upon carefully comparing them with those laid upon stored beans we find that the two do not fully agree, the former, in color and form, more nearly resembling those of *B. pisi.* We were thus forced to the conclusion that there was some other species working upon beans in the field, as we know there are other species working upon stored beans. Thus we received in January, 1885, *Bruchus quadrimaculatus* Fabr., swarming in what are called "black-eyed table beans" from Texas that were exhibited at the Atlanta Cotton Exposition. In oviposition in the stored beans this species differs from the common Bean Weevil under discussion in that it deposits its eggs in the beans. We have also received an allied species, *Bruchus scutellaris*, in 1885 from Mr. F. M. Webster, breeding in beans from the New Orleans Exposition. It is more than probable, therefore, that the eggs which are attached externally to the pods of beans in the field belong to one or the other of these last-mentioned weevils, and in fact they correspond in form and color with those of *B. quadrimaculatus.* Realizing that more careful observations were needed as to the habits of the common Bean Weevil in the field, and having a number of different kinds of dwarf beans growing in our garden at "Sunbury" the present summer, we have made a point of looking more carefully into the matter, and our examination showed that the parent *Bruchus obtectus* invariably oviposits within the pod, either using her jaws to make a slit or hole in the pod through which to insert the eggs, or waiting until the beans are sufficiently ripe to cause a partial opening of the pod, and then thrusting the eggs into the slit in masses. The perforation is almost always made along the ventral suture near a funiculus, and the eggs are most abundantly found within the pods that have already turned yellow and which contain the fully developed beans. Another peculiarity is that the post-embryonic larva, while capable of eating its way into the bean, very much prefers to enter through some perforation already made by one of its associates, so that in the same bean several larvæ are frequently found with but one perforation, all having entered through the same hole. That the eggs are frequently thrust into the green pod, though we have not yet found them in such, is proved by the fact that green pods which have been isolated have given out a number of beetles whenever the beans have been fully developed within them, though the pods themselves show no perforation. This would indicate that in the green pods the punctures close up. The development is very rapid, and at Washington beans taken from the field give out the mature weevils from the second week of August on, and commence at once to propa-

gate again. We have also been not a little astonished at the great abundance of the beetles reared from beans gathered in the field. From one of the green pods above alluded to, gathered July 15, we had obtained by August 15 no less than 62 individuals, and from a pod that was mature and yellow when gathered we have obtained no less than 91 beetles. The largest number of eggs which we have found in a single pod is 82, and these were thrust at the anterior end through a hole that had been gnawed by some Lepidopterous larva and not made by the parent weevil.

In size there is also very great variation, some specimens being really smaller than the typical specimens of the true *obsoletus*.

We hope in a forthcoming number to give all our notes on the food habits of the Bruchidæ.

NOTES ON THE HABITS OF SOME SPECIES OF COLEOPTERA OBSERVED IN SAN DIEGO COUNTY, CAL.

By F. E. Blaisdell, M.D., *Mokelumne Hill, Cal*

BUPRESTIDÆ.

Chrysobothris femorata Fab.—Pupæ and beetles have been taken from their burrows in the bark of the trunk of the Live Oak (*Quercus agrifolia.*)

Chrysobothris semisculpta Lec.—Bred from the half-dead limbs of Apple and Live Oak.

Chrysobothris californica Lec.—Extremely injurious to apple trees.

CLERIDÆ.

Cymatodera ovipennis Lec.—Larvæ taken from the burrows of *Ipochus fasciatus* in *Rhus integrifolia.* An immature beetle was taken from its cell in one of the burrows November 18.

PTINIDÆ.

Sitodrepa panicea Linn.—I have taken the beetles in large numbers from the following dried, compressed medicinal plants as they occur in drug stores: *Conium maculatum*, *Populus tremuloides*, *Hepatica triloba*, *Salvia officinalis*, *Hyoscyamus niger*, *Chimaphila umbellata*, *Borago officinalis*, *Convallaria multiflora*, *Leontodon taraxacum*, *Mellissa officinalis*, *Origanum marjoramum*, *Aralia racemosa*, *Celastrus scandens*, *Mentha piperita*, *Spiræa tomentosa*, *Asclepias syriaca*, *Atropa belladonna.* Does considerable damage to herbarium specimens.

Polycaon stoutii Lec.—Bred from Live Oak. Have taken it from burrows in almond trees and *Eucalyptus globularis.*

Polycaon confertus Lec.—Bred from larvæ found in the Live Oak and Almond. The beetles of both species of Polycaon have been observed to bore burrows into living trees.

Psoa 4-signata Horn.—I have bred this species from the dry prunings of the Grape-vine. Have observed the larvæ and pupæ in the dead stubs on living vines. Beetles appear in March, flying about in the vineyards during the heat of the day.

Lyctus striatus Melsh.—Bred from the branches of *Quercus agrifolia* and *Q. dubiosa.*

CUPESIDÆ.

Cupes lobiceps Lec.—Observed in all stages of development in the decaying stumps of the Live Oak.

CIOIDÆ.

Cis dichrous Lec.—Bred from a species of fungus which grows upon the Live Oak.

CERAMBYCIDÆ.

Ergates spiculatus Lec.—Larvæ obtained from the decaying roots of coniferous trees.

Prionus californicus Mots.—The larvæ of this species live in the decaying and rotten stumps and roots of the Live Oak. They never attack the living or sound wood. The beetles are plentiful at evening about groves, during July and August.

Phymatodes obscurus Lec.—I have bred this beetle from branches of the Live Oak.

Œme gracilis Lec.—Bred from the dead wood of *Quercus agrifolia* at Poway.

Elaphidion imbelle Lec.—Larvæ of this species plentiful in the dead wood of the Live Oak. The beetles are common beneath bark in August.

Megobrium edwardsii Lec.—Two beetles taken from beneath the bark of the Live Oak; one was just about to escape from its burrow.

Xylotrechus nauticus Mann.—Abundant about Live Oak groves during the months of July and August. The larvæ and pupæ have been taken from the dead branches and trunk of the Oak. The beetle is both diurnal and nocturnal in its habits, becoming active near the middle of the afternoon, continuing so until late in the evening. This insect is of considerable economic interest, being one of the few which commits serious damage to the wood of the *Eucalyptus globulus* in the United States. Several years ago it was stated by the tree-growers that Eucalypti were free from the ravages of pests, and that the wood was valuable for wagon-work, posts, etc., which greatly increased the

number planted. After a time many were cut down and piled to season with bark *in situ;* after several months' time the logs were overhauled and found to be perforated in all directions by a borer. The canals were filled with excrementitious matter; the subcortical furrows formed a dense network over the surface of the wood, partly involving the bark. Logs a foot in diameter were completely perforated. Many dead and living beetles were taken from the burrows; numerous larvæ were also obtained. Actual experience proved that such logs were absolutely useless even for posts, as rapid decay was induced by the entrance of moisture to the deeper parts.

Desmocerus auripennis Chev.—Bred from the dead wood of *Sambucus glaucus.*

Ipochus fasciatus Lec.—Larvæ taken from the wood of *Rhus integrifolia* at Coronado, and *Rhus laurina* at Poway.—*I. pubescens* Casey is similar in habits.

CHRYSOMELIDÆ.

Lema nigrovittata Guer.—In both the larval and imaginal states feeds upon the leaves and flowers of *Datura meteloides.* The eggs are laid in clusters of four to eight on the under side of the leaves. The larvæ cover themselves with excrement. They also feed on the cultivated *Daturæ*, *Burgmansiæ*, and *Cestrum aurantiacum.* *Sinea diadema*, a predaceous Hemipteron feeds upon the larvæ.

Trirhabda luteocincta Lec.—The larvæ and beetles feed upon *Artimisia californica.* The larvæ first appear in February, and after attaining their growth descend into the ground to pupate. The first beetles appear by the last of April.

Haltica torquata Lec.—Feeds upon the leaves of the Grape-vine and *Adenostoma sparsifolia.*

TENEBRIONIDÆ.

Phlœodes diabolicus Lec.—I have taken the larvæ and pupæ of this species from the decaying stumps of the Live Oak. These beetles feed on a large, tough species of fungus which grows upon the Oak. Once I took thirty specimens from one large fungus.

Iphthimus lævissimus Casey.—An immature beetle was taken from a stump of a Live Oak.

Gnathocerus cornutus Fab.—Observed in all stages of development in ground cereals of the stores.

CALANDRIDÆ.

Scyphophorus acupunctatus Gyll.—I have found this species upon the trunks of grapevines at Poway; it feeds upon the sap.

Scyphophorus yuccæ Horn.—Feeds upon the sap of the *Yucca whipplei* The larvæ live within the caudex.

SCOLYTIDÆ.

Micracis hirtellus Lec.—Bred from dead Willow at Poway.

Chætophlœus hystrix Lec.—I have bred this rare beetle from the dead wood of *Rhus integrifolia.*

Pityophthorus digestus Lec.—Associated with the preceding species and bred from the same wood.

LUCILIA NOBILIS PARASITIC ON MAN.

By Fr. Meinert.

[Translated by Martin L. Linell from the Særtryk af Entomologiske Meddelelser, 1 Bind, 3 Hefte, 1888.]

It is an old story that the human body is subject to attack from several ecto- and endo-parasitic insects, and a whole literature is cited by Hagen on *Insecta in corpore humano.* It is principally Dipterous larvæ that are recorded and described as occurring in the stomach, or vomited through the mouth, or in the intestine or ejected through the anus, or carried out with the urine, or occurring in the nasal cavities, or finally living beneath the skin, in the eyes or in the ear. All recorded cases are not reliable, and the present author will not deny that he belongs to the skeptics in regard to many published stories, and he also thoroughly doubts that any Dipteron is sufficiently specialized to live exclusively in or upon man, not even excepting the South American *Lucilia hominivorax.*

In recent years Dr. G. Joseph, in Breslau, has applied himself to the subject of diseases caused by or accompanied with attacks by Dipterous larvæ, and he has established or more definitely determined a peculiar form of disease—Myiasis or Fly-disease—in several chief forms, partly as *Myiasis dermatosa muscosa* (caused by Muscidæ) and *M. der. œstrosa* (caused by *Œstridæ*), partly as *Myiasis interna* and *M. septica.* Among the Dipterous larvæ mentioned by Joseph the larvæ of *Sarcophila wohlfarti* may be of special interest. The fly was raised from larvæ that occurred in the nasal cavities and in the ear of man, first by Wohlfart (1770) and more recently and in larger numbers by Portschinsky (1875–'84), who has satisfactorily studied the species. At large the fly is very rarely found. Joseph gives in his essay "Ueber *Myiasis externa dermatosa*, 1887," a description of the fly and its larva.

At the end of August, 1887, I received from Dr. A. Iverson a dozen rather small Dipterous larvæ that were said to have been taken from the ear of a man with ear discharges, and which he thought he got by sleeping on the grass. The larvæ came in glycerine and were partly shriveled up, and I therefore did not think fit to do anything with them, but wrote back that it was probably *Sarc. wohlfarti*, although

this species had not hitherto been known to occur in this country. A few days later I received from Prof. R. Bergh two larvæ, coming from the same patient, but this time they were alive, and in the glass vial with them I also found pieces of muscle and small fat cells in decomposition, wherein the larva moved freely and in a lively manner. The next day one of the larvæ had already quit the putrefying and malodorous mass and had pupated on the inside of the stopple, and the next day also the other larva was found to have pupated. I successfully raised the fly, and after ten to eleven days there emerged a pair of insects, which, however, were not the expected *Sarc. wohlfarti*, but belonged to the genus *Lucilia* – *L. nobilis* Meig. Of this genus we have with us eight species, of which one(*L. cæsar*) is one of our commonest green metallic flies. That the fly reared is one of our rarest species of *Lucilia* I do not think of any importance in regard to the special habitat of the larva, as all the eight species resemble each other so much as to cause mistakes, and it is not reasonable that one of them should have a mode of living, different from the others, in regard to parasitism on man. Besides it is already known that this genus in Europe occurs with man, but it is recorded as a rule only as vomited from the stomach. Finally, I will only remark that in the possession of Dr. Borries I have seen a pair of this species, reared from larvæ, coming from the above-mentioned patient at the general hospital.

The following is an extract from the hospital journal:

A seaman took a bath at the seashore and afterwards lay down to sleep on a sunny spot near the shore and close to a cave; seaweed was in the neighborhood. Awakening he felt a strong humming in his ears and had a sensation of water in them, which in the next few days changed to strong pains that prevented him from sleeping and were followed by discharge of blood and pus from both ears, but especially from the left, and from his nose. Was taken to the general hospital August 21. Complained of heavy tormenting pains in both ears, from which flowed pus mixed with blood. After cleansing with water there were discharged, especially from the left ear, some white maggots (dipterous larvæ), which seemed to stop up the ear cavity. Could not hear a pocket watch close to his ear. Nose and ears both attacked. Complained August 22 continuously of pains, especially in his left ear, which seemed filled up with living maggots, of which some regularly leave at every washing; no maggots found in his right ear. August 23, only one large maggot was discharged, and he himself thought that this was the last one. The otoscope showed strong constriction of both ear tubes, etc. The discharge soon stopped completely.

BIOLOGIC NOTES ON NEW MEXICO INSECTS.

By C. H. Tyler Townsend, *Las Cruces, N. Mex.*

The observations herein published have been collected from time to time on the native insects of this Territory, especially of the southern portion. As it is not practical at this date to publish them in station bulletins, they are offered here, especially as they are of much scientific

and considerable economic importance and will add not a little to our knowledge of the southwestern fauna.

COLEOPTERA.

Rhizophagus sp.—Collected a large number of a small, elongate beetle of this genus on a living 12-foot flower stalk of *Dasylirion wheeleri*, in Soledad Cañon, Organ Mountains, May 23. The beetles were distinctly seen to be eating into the young paniculate flower buds, which were at this date just developing beneath large protecting scales on the main stalk. Under these scales the beetles were numerous and not only the embryo flowers, but the stems which held them, had been extensively eaten. Beetles determined by Dr. H. Skinner; plant by Mr. W. H. Evans.

Gyascutus planicosta Lec.—This large Buprestid was found July 8 on mesquite bushes (*Prosopis juliflora*) and later on flowers of the same. On July 17 great numbers were seen on flowers of *Larrea mexicana* or Creosote Bush. When found on the flowers they are covered with pollen, giving them a rich yellow color. Determined by Dr. Skinner.

Thryncopyge alacris Lec.?—This is a beautiful Buprestid of an orange yellow and purplish blue or green color. It bores the dead standing last year's flower stalks of *Dasylirion wheeleri*, the eggs being undoubtedly inserted when the stalk is green. The dry stalks are very woody and hard, and dead imagos of this species were found in them August 22, in the San Andres Mountains. Almost every last year's Dasylirion stalk in this region is bored and tunneled throughout its length by this Buprestid. On May 18 large numbers of live pupæ were found in the stalks and a very few larvæ. The larvæ were apparently about full grown, and these are undoubtedly last year's stalks. This Buprestid requires but one year for its transformations. Some of the pupæ were beginning to assume the chitinized condition and color of the imago, but most of them were still white. The pupa of a hymenopterous parasite was found in a thin silken cocoon in one of the burrows. May 29 to 31, eight of these beetles emerged from sections of stalks which had been placed in breeding cages. Identified by comparison with plate of Mexican Buprestidæ, in La Naturaleza, by Dr. Eugène Dugès.

Macrodactylus uniformis Horn.—The Macrodactylus referred to in INSECT LIFE (vol. IV, p. 26), proves to be this species. It has been found eating the leaves of grapevine (l. c.). Determined by Dr. Skinner.

Anomala binotata Gyll.—Several taken May 23 on flowers of *Robinia neomexicana*, in Soledad Cañon. Determined by Dr. Skinner.

Allorhina mutabilis Gory.—This was referred to as *A. nitida* both in INSECT LIFE (vol. IV, p. 26) and in Bulletin No. 3, New Mexico Station (p. 15); and later as *A. sobrina* var. (on authority of Dr. E. Dugès), in Bulletin No. 5, New Mexico Station (p. 10). It has recently been determined by Dr. Skinner as this species.

Prionus californicus Mots.—The borers mentioned in Bulletin No. 5,

New Mexico Station (p. 9), under head of "Root-Borers," belong to this and perhaps one or two other species. An adult captured here was determined by Dr. Skinner as this species.

Tragidion armatum Lec.—This Cerambycid bores the flower-stalks of *Yucca angustifolia.* On May 24 and 30, adults of this species were found gnawing green flower-stalks, in some places; on latter date numerous fresh scars were noticed. I could, however, discover no eggs beneath these scars. On May 19 of the following year, a fully transformed adult was found within its burrow in a dead and dried last year's flower-stalk of this Yucca. It was apparently just ready to emerge from the stalk, as it was very active. Determined by Dr. Skinner.

Schizax senex Lec.—On April 14 a small specimen of this species was found, transformed and dead, in a gallery in dead wood of a growing Apricot tree. It had changed to the beetle in a little horizontal burrow or cell at the top of its rather long vertical gallery. Determined by Dr. Skinner.

Sphænothecus suturalis Lec.—A pair of this longicorn was taken *in coitu*, July 8, on Mesquite (*Prosopis juliflora*). Determined by Dr. Skinner.

Pachybrachys atomarius Melsh.—May 12 and later this species was beaten from Mesquite (*P. juliflora*). Very probably feeds on this plant. Determined by Dr. Riley.

Chrysomela exclamationis Fab.—Taken in small numbers, through June, on Sunflower (*Helianthus* sp.). Determined by Dr. Skinner.

Chrysomela dislocata Rog.—Taken June 29 and 30 on *Malvastrum* sp. Determined by Dr. Skinner.

Diabrotica tenella Lec.—On page 16 of Bulletin No. 3, New Mexico Station, this beetle is referred to as *D. 12-punctata* Oliv., of which it has been considered a variety. It is there recorded as eating tender leaves and blossoms of peas in April. It is found through July on Squash, Sorghum, and many other plants. September 1 it was received from Mr. F. E. Downs, of Eddy, N. Mex., with report that it was eating everything—trees, vegetables, and even potatoes. Mr. Downs's ranch is in the Guadalupe Mountains, about 35 miles from Eddy, and at an elevation of about 5,000 feet. Determined by Dr. Skinner.

Haltica foliacea Lec.—This beetle was referred to on page 6 of Bulletin No. 3, New Mexico Station, as *Graptodera chalybea* Illig. Found through June on the vine and on a tall weed (*Œnothera* sp.?), the leaves of which it had perfectly riddled with holes. July 8, and for some time previously, reported on Apple, particularly young trees. On July 24 it was received from Mr. Downs, of Eddy, N. Mex., with report that it had just destroyed the leaves for him on 1,000 apple grafts. Determined by Dr. Skinner.

Cryptoglossa lævis Lec.—This Tenebrionid is very common in houses here, but is met with only in the adult state. It is crepuscular, and

emerges at night from holes and cracks in the walls. One day in March, after a slight rainfall, several dozen of these beetles were counted crawling from holes in the ground near the base of an adobe wall in one of the streets of the town. Determined by Dr. Skinner.

Pyrota postica Lec.—This large black and yellow Meloid occurs very numerously on *Larrea mexicana*, or Creosote Bush, particularly on the flowers. Determined by Dr. Skinner.

Myodites nevadicus Lec.—Two specimens of this Stylops-like beetle were taken on flowers in May and June. I am strongly of the opinion that this is the adult of a parasite which I have taken from the abdomens of our common yellow social wasp, *Polistes aurifer*. Determined by Dr. Skinner.

Eupagoderes decipiens Lec.—Beaten May 10 from flowers and foliage of Mesquite (*P. juliflora*). Whether or not they breed in this shrub, it is certain that they feed on it in the perfect state. The jaws of each of three specimens taken were gummed with the greenish chlorophyll upon which they had evidently been feeding. These beetles were infested with red mites. Determined by Dr. Skinner.

Pandeletejus cinereus Horn.—Beaten in large numbers from Mesquite (*P. juliflora*), May 12 and later. It was noticed *in coitu* May 16. It may breed in the Mesquite pods. Determined by Dr. Riley.

FURTHER NOTES ON THE NEW HERBARIUM PEST.

By C. V. Riley.

My friend Mr. R. McLachlan, of Lewisham, England, has kindly called my attention in connection with the article on "A New Herbarium Pest," Insect Life, vol. IV (pp. 108–113), to the fact that a similar insect, viz, *Acidalia herbariata* Fab., has long been known to injure herbarium specimens in Europe, but is perhaps more injurious in herbalists' shops than in museums, and that the figure of our American insect looks a good deal like it.

The descriptions of *Acidalia herbariata* show it to be allied to *Carphoxera ptelearia*, but, nevertheless, when carefully compared, the two are found to be very different structurally. Dr. F. J. M. Hylaerts gives, in the *Annales de la Société Entomologique de Belgique*, 1878 (vol. XXI, pp. 5–8), the fullest descriptions accessible of the larva and pupa of *A. herbariata*, and notwithstanding the minuteness of the descriptions, no mention is made of the structural characters to which I called attention, both in the larva and pupa of Carphoxera. The colorational marks are also quite different, though in this respect, so far as the larva is concerned, they are admitted to be quite variable. *Acidalia pusillaria* Hübner (Samm. Eur. Schm., Geom. Fig. 99) and *A. microsaria* Boisd. are synonyms of *herbariata*, Fabr., and neither of these

last-mentioned authors gives any characterization that would indicate the structural peculiarities of Carphoxera. The other figures (Fischer v. Rosl., Pl. 61; Dup. v, Pl. 173, Fig. 5) accessible of *A. herbariata* also show a different insect, but as both figures and descriptions are often defective, I was anxious to be able to compare actual specimens, and though I have been unable so far to obtain the adolescent states of the European insect, I have obtained a pair of the imagos through Dr. Staudinger. They confirm the differences, and show the European moth to be twice as large, more glossy, and differently marked in detail.

Aside from colorational differences, therefore, *Carphoxera ptelearia* is easily distinguished from *Acidalia herbariata* by the spatulate tubercles of the larva, by the lateral projection on the fifth abdominal joint of the pupa, and by much smaller size, more pulverulent, less glossy scaling, and different markings in the imago.

Coming, as the American insect evidently did, from the more arid regions of Mexico and the Southwest, it did not occur to me to look into the European literature of the subject of Lepidopterous herbarium pests, and the statement in reference to Carphoxera that "this is the first true Geometrid, so far as I know, recorded as feeding on dry and dead vegetation," should have been qualified by "in America." I note also that according to Guenée *Hyria aurorarua* has a taste in the larval state for dry leaves.

Dr. J. N. Rose informs me that Mr. S. Parrish, of San Bernardino, Cal., reports a similar larva in his herbarium, while the following extract from a letter from Walter H. Evans, of Crawfordsville, Ind., March 7, 1892, would indicate that the species has been introduced there also from Arizona plants:

> Just after your paper in the Botanical Gazette on a new herbarium pest, I found three larvæ in some Arizona plants of last season's collecting, which I intended sending you, but failed to do so. They were mislaid, but if I can find the box in which I placed them, shall still do so. The plants most attacked were Pentstemon and Castilleia, which were riddled.

THE AUSTRALIAN ENEMIES OF THE RED AND BLACK SCALES.

Mr. Koebele's hopes that in *Orcus chalybeus* he had found and sent to California an insect which would prove as important an enemy of the Red Scale as *Vedalia cardinalis* proved for the Fluted Scale, seem so far not to have been justified. Under date of June 8, Mr. Coquillett wrote us as follows:

> In regard to *Orcus chalybeus* I will say that yesterday I spent several hours looking for them among the orange trees where I turned some of them loose from time to time, and found several of the beetles. The last that I turned loose in this locality was about two months ago (April 15). Those seen yesterday were enjoying the luxury of doing nothing. It has now been over six months since I received the first

consignment of these early birds (November 28). In the year 1888, the first Vedalias reached me November 30, and by the next June they had cleared several trees of Icerya and I had sent many colonies to various fruit-growers. The statement that has been published, that the Orci would be to the Red Scale what the Vedalia has been to the Icerya, comes wide of the mark. They are not one-tenth as efficient as the Vedalias. From the last consignment received from Koebele, May 14, I selected about twenty-five specimens of *Orcus chalybeus*, of both sexes, and placed them in a large glass jar supplied with orange twigs infested with Red, Black, and Soft Brown Scales and Aphids, replenishing the jar every few days with new material; I kept the jar in my office and examined it at short intervals, but up to date not an egg has been laid, nor have I seen the beetles paired. *Orcus australasiæ* has acted in the same way. Under similar conditions, *Leis conformis* paired and laid eggs freely, and I have its larva in the fourth stage. *Psyllobora galbula?* also paired and laid eggs when treated in this way. Of course, it is possible that the Orci may require very hot weather before they propagate freely. It has been exceptionally cool here thus far this spring. They have not done any better under a tent inclosing an infested orange tree. It is quite certain that both species of Orcus are permanently established here.

July 27 he again wrote us, giving the results of further observations, which, while proving that this ladybird is now reproducing in California, gives no added hope of rapid multiplication and the consequent value of the species as a destroyer of the Red Scale:

Yesterday I examined the orange and lemon trees in this city where I had turned loose the living specimens of *Orcus chalybeus* received from Mr. Koebele prior to the middle of April. About three-quarters of an hour was spent in searching for these insects, and during that time one cluster of eggs, a nearly grown larva, a dozen pupæ, besides several empty pupa cases, also a dozen beetles, were found, mostly upon the tree upon which I originally placed the beetles, a few being found upon the trees immediately adjoining this one. The results of this examination confirm my previously expressed opinion that this species is now established in this State beyond a peradventure.

The following description of some of the early stages of *Orcus chalybeus* has also been transmitted to us by Mr. Coquillett, and we take the first opportunity to place it upon record:

ORCUS CHALYBEUS.

Egg.—Light lemon-yellow, smooth and polished, except the upper end, which is very scabrous; form, elongate-oval, being slightly over twice as long as its greatest diameter; length, 1¼ mm.

Attached at one end, which is slightly flattened. Deposited on the upper side of an orange leaf in a cluster numbering five eggs.

Mature larva.—Body whitish, marked each side with a subdorsal and a suprastigmatal row of black spots, situated at the base of the spines, the spots darkest in the center, not extending upon the first segment, the two spots on each side of the second segment united into a single spot, as are also those on the third segment, these spots being more conspicuous than those on any of the remaining segments; first segment bearing twelve spines, six in a transverse row on the front edge, an oblique pair each side near the middle of the segment, and two subdorsal spines near the hind margin of this segment, one on either side of the middle of the dorsum; second segment bearing eight spines, four in a transverse row, and below each of the lowest ones is a pair of spines placed longitudinally; each of segments three to seven bears six spines arranged in a transverse row; segments eight, nine, and ten each bears four spines arranged in a transverse row; segment eleven bears a single pair of spines

arranged transversely, while the twelfth or last segment is destitute of spines; the spines above mentioned bear several lateral and apical bristles, those at the apex being somewhat over one-half as long as the spine itself; the spines are quite dusky, except those lowest down on each side of the body, which are white; length, nearly 7 mm.

When about to pupate the larva attaches itself by the hind end of its body to a leaf or other object, and the old larval skin splits open from the head to the ninth segment.

Pupa thinly covered with a light-yellow pubescence, light citron-yellow; head nearly surrounded with blackish; first segment marked with two oblique black spots on the dorsum, second segment marked with two similar but much larger spots, third segment marked with two smaller black spots, fourth segment marked with two dusky dots which are scarcely apparent; fifth, sixth, seventh, and eighth segments each marked with two somewhat transverse black spots, those on the sixth and seventh segments larger than any of the others; wing-cases bordered above with black; length 5 mm.

The other species of Orcus, namely, *Orcus australasiæ*, however, seems to be doing better. Mr. Coquillett formed this impression some time since, and further observations confirm its correctness. He finds it difficult, as above stated, to rear *O. chalybeus* in confinement, since the larvæ appear to attack only the recently hatched scale-insects. The larvæ of *O. australasiæ*, however, being larger and stronger than those of the other species, tear off the hard shell of the Red Scale and feed upon the insect itself. Moreover, it breeds more surely. From some cause, climatic or otherwise, *O. chalybeus* is unsuccessful in transforming in the majority of cases. For instance, out of a cluster of five eggs of *chalybeus*, attached to the upper side of an orange leaf at one of Mr. Coquillett's breeding stations, only a single egg hatched, and out of eight pupæ collected at the same time, only two produced beetles.

EXTRACTS FROM CORRESPONDENCE.

On the Carbon Bisulphide Remedy against stored Grain Pests.

Allow me to add an important item in the method of keeping weevils and rats out of a corn crib, by the use of the vapor of bisulphuret, or bisulphide, of carbon.

The improvement I expect to make this year is to place on the floor of the bin an oblong box made out of two 12-inch boards, the upper part coming to a sharp point. The box is to be long enough to run two-thirds through the bin, boxed up at the inner end to give it support. There is to be for a few feet from the inner upper edge an opening cut out about half an inch wide to give free vent for the vapor to penetrate the corn. The necessity of this arrangement is, after the bisulphide has disappeared by evaporation, to replace it with a fresh supply. This is to be done in particular to keep out rats the year round. One good fumigation of the vapor is sufficient to kill the weevils, but it will take somewhat a continuation of the evaporation to keep out rats.

As you are aware, the bisulphide of carbon is a highly volatile fluid, and the contents in an open bottle will readily disappear by evaporation. To replenish the fluid by the use of the long box, say every few months, would be all that is required, and instead of using several bottles at once imbedded in the corn, I would use but

a single bottle at a time. By this method the experiment will be brought to a successful issue, and the expense of protecting a bin of corn is not materially increased, but rather diminished.

To place a bottle of bisulphide in the box described, take a wooden shovel with a little box attached at the end of it to snugly hold the bottle. Let the handle be about an arm's length shorter than the box. Before introducing the fluid I would close up the bottle with a few layers of muslin, and by the aid of the shovel place it inside of the box, nearly to the inner end, leaving the shovel with the bottle inside; then close up the entrance at the door with old bags or something of the kind.

I learn that some have apprehensions as to the personal safety in using the bisulphide of carbon, and the effect it may have on the corn. As I have ascertained by experiments, the line of ignition is close to the body of the fluid itself, therefore there is no danger in taking a light into the bin. As to the effect on the corn, everything is in its favor. My last year's corn treated with the carbon proved that hardly a kernel failed to germinate, and the shucks were eaten by the stock, I thought, with unusual relish. The cause of this is obvious. The corn grew rapidly and with vigor, and was considered the best in the neighborhood. Whether the bisulphide had anything to do with it, I will not say; but I am somewhat inclined to think it had. We know that solutions of some of the metallic salts have a tendency to stimulate favorably the growth of seed that is immersed in it.

I only know of one great danger in handling the bisulphide, in which I nearly lost my own life. The experimenter may pour it into the opening of an ants' nest, to destroy them, and safely ignite it at the hole with a match. After the explosion it leaves for a while an invisible flame at the opening. If he is tempted to recharge the opening from a full bottle of the fluid in his hands it will explode and send him without a moment's notice into the other world!

It is supposed that nearly 50 per cent of the corn in Texas is annually destroyed by weevils and rats. The destruction is so great that nearly all the corn used in this part of the State comes from Kansas.—[G. P. Hachenberg, M. D., Texas, June 25, 1892.]

On the first Use of Paris Green for the Potato-beetle.

Yours of recent date, asking for corroborative testimony about my having used Paris green for poisoning Potato beetles in 1867, was duly received. In reply I can only say that I can find nothing of published record to confirm my statement. Twenty-five years make sad havoc with memories as well as with friends themselves. Those who are still alive of my friends gave the subject so little thought that they have no idea of the date. The newspaper which published the clergyman's article suspended publication about eighteen years ago. Its then editor and the clergyman who wrote the article have been dead many years. So you can see the difficulty in my way. But I am positive in the date. The fact that I let slip a grand opportunity to make money out of the discovery is not the least among many reasons why I have the date firmly fixed in my mind.—[Byron Markham, Michigan, June 3, 1892.

REPLY.—The Entomologist regrets the absence of corroborative testimony concerning your use of Paris green against the Colorado Potato-beetle in 1867, and though he has no reason for doubting your statement the record as he has published it is justified and can not well be altered.—[June 7, 1892.]

A Vineyard Pest, *Anomala marginata*, in North Carolina.

I forward by this mail some specimens of a beetle for identification. It appeared about the time the "Rose Bug" disappeared, about June 10. I had noticed it during former seasons; but only isolated specimens appeared. Now, however, the beetles are swarming in great numbers and have done much damage, notably on a plant of one-year-old grapevines, where the foliage presents the appearance of lace work. They

have not attacked the berries at all. They are also attacking the foliage of apple and plum trees. I do not find them on pear. I have been deterred from trying the effects of spraying the vines with arsenites, because of the advanced growth of the berries, but find that the Bordeaux mixture has no effect on them. Unlike the "Rose Bug," they make a prolonged stay, and for that reason are greatly to be dreaded. I have destroyed them by thousands, by shaking them off the vines, into pans of water with a little kerosene oil in them. I find no difficulty in doing this, as they let go the moment the leaf is touched. On reaching the ground they burrow like a mole, and as quick as a wink. I have kept all my available force at work for some time destroying them as above mentioned; but, as they have apparently come to spend the summer, this method, in a large vineyard, is very expensive. Any information you can give me regarding preventive or destructive agents and their use will be thankfully received—[John K. Hoyt, North Carolina, July 8, 1892.

REPLY.—The insect injuring your grapes and apples is a Scarabæid beetle, *Anomala marginata*, previously mentioned in INSECT LIFE, Vol. I, p. 220, as injuring the Vine in Texas. This species has not hitherto been noticed as far as we know to attack the Apple and Plum. Spraying with one of the arsenicals would be the most certain and thorough remedy, but, as you say, in the case of advanced growth of the berries such spraying might be attended with some danger. If you could spray the other plants which are also attacked by the insect, its numbers would doubtless be greatly reduced. You might also try dusting the vines with lime or spraying them with a 15 per cent dilution of the kerosene emulsion, either of which would probably make the vines distasteful to the insects and cause them to seek elsewhere for food. The method of destroying them which you have followed, namely, by shaking them into water with a little kerosene, is a good one, except for the fact that it is a temporary expedient and does not deter fresh hordes of beetles from attacking the vines.—[July 13, 1892.]

A "White Grub" Pest of Sugar Cane in Queensland.

It has been in my mind for some time to write you concerning an insect which interests Queensland planters in a very practical way and about which I hope to interest you. Our plantations, particularly those devoted to the growth of Sugar Cane, are just now suffering from the ravages of a dreadful scourge in the shape of a grub, very like the larva of the *Lachnosterna fusca* of your country. This grub literally swarms in nearly all the cane fields the whole length of the Queensland coast. I can give you many facts to show the extraordinary voracity of this pest and the extent of its ravages. One planter assured me that upon an estate of 1,000 acres he has lost 400 acres of cane. Another figures his loss during the past at between £4,000 and £5,000 sterling. Cases of this kind might be multiplied almost indefinitely.

I may say that the insect itself is known as *Lepidiota squamulata*. So far planters are powerless in its presence. The only attempt at circumventing it is made by hand picking. In the South Sea Islands a boy follows every plow with a four-quart tin pail, and very frequently he is able to fill this pail in going across a small field. The traveling inspector of the Colonial Sugar Refining Company tells me that upon one of their plantations they have during the past season picked of these grubs no less than 700 pounds weight from a single acre. You do things in a large way in America, but can you beat this?

I have recommended the planters to try kainit, which I see referred to in INSECT LIFE as having been useful in the case of cutworms and other underground larvæ, but so far the kainit has not the slightest influence in checking the ravages of this grub. Can you suggest anything in the way of a remedy? If you can only give us a hint in this direction that is at all workable I can promise you that your reputation in Australia, great as it now is, would be made so far as we could make it. I notice in one of the American papers a statement to the effect that a French com-

pany is sending out hermetically sealed vials containing a fungus which is said to be most destructive to larvæ like the one under consideration. Do you know anything about it?

I get Insect Life regularly and value it highly. * * * [E. M. Shelton, Queensland, Australia, June 8, 1892.

Reply.— * * * The insect which you report as so seriously affecting sugar-cane plantations on the Queensland coast is, from the very nature of the case, as you will readily see, a most difficult one to counteract. The occurrence of this insect and its work have never been brought to my attention and its habits in the imago state are altogether unknown to me, though I doubt not similar to various American Lachnosternas. In this country, particularly here in Washington, we have very successfully treated lawns infested with white grub by soaking the ground with kerosene emulsion, as described in the first volume of Insect Life on page 48, and I believe that this will perhaps prove to be the only practical remedy against your insect. The emulsion of kerosene could be distributed by means of some of the injecting devices manufactured in France for use in disinfecting vineyards of the Phylloxera with bisulphide of carbon, and this latter substance, too, would be an effective remedy against the grub were it not for the expense of applying it on so large a scale. The expense of the application would also be a great obstacle to the use of kerosenee mulsion, though this last would be much cheaper than the bisulphide. At this distance and in entire ignorance of the habits of the adult insect, I can give you no further advice as to the best remedies. It is possible that the food-habits of the adult insect will furnish a more easy and practical, not to say cheaper, method of controlling it. This would be the case if the beetle is known to feed on any plant which could be sprayed with Paris green or London purple. I should be glad to get specimens of the insect in all stages, and also, if you can furnish it, a full account of its habits in other than the larva state.

With regard to the White Grub fungus which the French firms are advertising, I have no confidence whatever in it. I have experimented with it and believe that the results have been generally overstated and that the fungus is being pushed merely as a speculation. * * * [July 14, 1892.]

A Snout-beetle, *Otiorhynchus ovatus*, under Carpets.

Inclosed please find a number of beetles found under the edge of a carpet. Have been noticed by a number of families in this vicinity under carpets. Would like to know whether they eat the carpet or prey on the "Buffalo Bug" which has been destroying the carpet under which the inclosed were found. Would be pleased to learn the name, habits, and something of the life-history of these insects.—[Paul Van Riper, Michigan, July 27, 1892.

Reply.—The beetles which you find under carpets in your vicinity belong to the species known as *Otiorhynchus ovatus* Linn., of the Snout-beetle family Otiorhynchidæ. This insect is common to Europe and Siberia and was doubtless introduced at an early date, although the first record of its occurrences here was published in 1873. It is a northern species, being restricted to our most Northern States and Canada, and is in some localities commonly known as "the graveyard bug." In the Annual Report of the State Board of Agriculture of Michigan for 1883 (pp. 425–429) Mr. C. M. Weed gave an account of the main facts in the life-history of the insect, proposing for it the name "Strawberry Crown Girdler" from the habits of the larva of girdling the crowns of the Strawberry. Prof. A. J. Cook found the adults of this species feeding on the leaves of Borage, and it is probably, like a congeneric and closely related species, *O. sulcatus* Fab., a very general feeder. A short account of the latter will be found in vol. IV of this periodical (pp. 222–223).

Your experience in finding these beetles congregated indoors is interesting but not unprecedented. In the Michigan report, above referred to, brief mention is made of Dr. J. A. Lintner's having found a house swarming with them, and in Dr. Lintner's

Second Report of the injurious and other Insects of the State of New York a precisely similar instance is recorded. No explanation, however, has been offered of the phenomenon. This species is strictly phytophagic and it would be as impossible for it to feed upon the carpets as it would be to prey upon the "Buffalo Bugs." The beetles are nocturnal, and hide in dark places by day, venturing forth at night to feed. They are also gregarious and wingless.

A possible explanation of this occurrence in dwellings offers itself. They might have been feeding on vegetation of some sort in the immediate vicinity of, and probably actually in contact with, the house infested. With the approach of day they would naturally seek some dark hiding place, and after crawling into the house were unable to find their way out. This would be the more likely in dwellings covered at some point with climbing vines.—[August 2, 1892.]

The Grape-seed Weevil.

I send for your examination a few grape berries punctured by an insect, same as I attempted to describe in letter to you last January, and in reply to which you said there were two insects which punctured grape berries and asked me for specimens.

I am glad to say I can furnish but few specimens this year, my vineyard being almost clear of them, whilst last year my whole crop as well as my neighbors', were destroyed. I have sprayed with Bordeaux mixture five times this season and so far have been clear from black rot. I have not gathered a pint of rotten berries from two acres of grapevines. My neighbors who have not sprayed report only a defective berry here and there, consequently can see no difference between sprayed and unsprayed vines.—[Thos. R. Walker, Kentucky, July 25, 1892.]

Reply.—Examination of specimens sent shows that your grapes are infested by the so-called Grape-seed Weevil (*Craponius inæqualis*), which is one of the most difficult insects to fight. If you knew the exact time at which the insect laid its eggs something might be done in the vineyards, if not too large, by jarring the insects upon sheets saturated with kerosene, and it is likely, as is the case with the Plum Curculio, that the weevils feed for a time in the spring before the grapes are large enough for egg laying. If this should prove to be correct a spraying with an arsenical solution would destroy them before they have an opportunity to oviposit.—[August 1, 1892.]

A new Enemy of Cotton.

I send three specimens of insects. The little black ones are doing great damage to cotton blossoms. The speckled one was with them, but not so numerous. The long one was also engaged in eating the cotton blossoms. In looking over a ten-acre plot of cotton, at least one-fourth of the cotton squares were stripped of their leaves. Would like to know about them, and remedy.—[J. S. Davitt, Polk County, Georgia, July 12, 1892.]

Reply.— * * * The "little black" beetle is *Luperus brunneus*, of the family Chrysomelidæ, or leaf-beetles. This is known to injure the blossoms of hollyhocks and the silk of corn, but has never been reported before as a serious enemy of cotton. The "speckled" beetle is *Megilla maculata*, one of our commonest species of lady-birds (Coccinellidæ). Since its food consists mainly of plant-lice, which are so abundant on Cotton, it must be considered as a beneficial insect. The "long" specimen is *Monocrepidius vespertinus*, of the family Elateridæ, or click-beetles. It has frequently been observed to feed on the leaves or blossoms of cotton throughout the whole cotton belt, but it is not common enough to do any serious damage.

It is safe to say, therefore, that the damage you complain of has been caused by the Luperus mentioned above, and if this species should continue to be troublesome I would advise the use of the arsenites as practiced against the Cotton Worm.—[July 29, 1892.]

Corn as a Trap Crop for the Boll Worm.

My mind is made up now concerning the protection afforded tomatoes by corn. My tomatoes suffered badly during the presence of second broods of worms in June. No silks in corn 200 yards away. Third brood of worms plentiful in corn in silk; no worms in tomatoes in same patch. At a neighbor's farm, a second brood of worms ate or bored into at least 50 per cent of tomatoes; corn not in silk. Third brood plentiful in corn when in silk; no worms in tomatoes in same patch. The above verifies observations of last season, though my object then was to test preference for host plants then in my garden. Will say that at other gardens, not referred to above, have found conditions as mentioned, and I am perfectly satisfied that any tomato crop can be protected by judicious use of corn, by crushing the first brood in the tops of corn early in and throughout May, or by planting an extra early variety of corn that will be in silk by the 1st of June. * * * The fourth brood of worms will be at work about August 15 in trap corn that is planted for protection of cotton, and which, I am certain, will prove satisfactory in every instance tried. I fully indorse the report of your able field agent, Mr. Mally, on every practical point, and would emphasize all he says in the strongest terms concerning corn as a trap for the worms—plantings adapted to the appearance of the different broods; in fact, I believe it to be the only sure and certain way to protect a cotton crop. Poisons should be abandoned, for reasons set forth on page 53, Bulletin 26, of your Division. Tried them thoroughly last season. Lights are a failure, as proved under all circumstances, and, as I conceive, our only hope is trapping in corn, colonizing the worms, and centralizing natural enemies.—[S. B. Mullen, Mississippi, July 18, 1892.]

Silk Gut from native Silk-worms.

I am endeavoring to breed the larvæ of *Attacus cecropia*, *A. polyphemus*, and *A. luna*, with a view to obtaining silk gut stronger and longer than that at present furnished to anglers by that of the *Sericaria mori*. I have already a good supply of eggs awaiting development, and if you could give me any hint as to food or method of keeping and rearing I shall esteem it a great favor.—[John Harrington Keene, New York, June 27, 1892.]

REPLY.— * * * You will have little difficulty in rearing the larvæ if you inclose them upon a branch of the tree upon which they naturally feed. Use a very large mosquito-netting bag for this purpose, and watch it carefully to see that no holes are worn into it through which a bird could get entrance. The *cecropia* can be reared to the best advantage upon Apple, the *polyphemus* upon Elm, Maple, or Willow, and the *luna* upon Beech, Butternut, Birch, or Liquidambar. The Department has never furnished eggs of any insect except the Silk-worm of commerce, and since July, 1891, has not been able to furnish even these, since Congress has abolished the work of the silk section. I shall be glad to learn the results of your experiments.—[June 28, 1892.]

Corn Stalk-borer in Virginia.

Accompanying this are some stalks of corn badly eaten by worms. These are some of the worst specimens, but whole fields are attacked. Please give me your best method of counteracting them, or of preventing their depredations. They seem to be increasing every year, and with dry or unfavorable weather they may destroy the corn crop. With fine growing weather the corn seems to be strong enough to overcome their effects in a measure.—[P. C. Waring, Virginia, June 23, 1892.

REPLY.—The insect which is damaging your corn is the Larger Corn Stalk-borer (*Diatræa saccharalis*). This species has been treated in Nos. 3 and 4, volume IV, INSECT LIFE, where you will find all the information we have to give. If, after reading this article, you have any additional facts to convey, the Entomologist will be very glad to receive them.—[June 28, 1892.]

A Leaf-roller on Shade Trees in Colorado.

We send specimens of the Canker-worms which infest our trees. In all cases they seem to start on the Box-elder trees, and from that drift over to the Maples, Elms, and finally even affect the Spruce trees. We have found the spraying you recommend to be very efficacious.—[The Roberts Hardware Company, Colorado, June 23, 1892.

REPLY.— * * * The larvæ which you send and which were infesting your Box-elder shade trees can not be called Canker-worms, as they belong to the so-called Leaf-rollers (family Tortricidæ). The species is in all probability the Box-elder Leaf-roller (*Cacœcia semiferana*), described and figured by Professor Gillette upon pages 10 to 15 of Bulletin No. 19 of the State Agricultural College Station, Fort Collins, Colo., although it differs in some respects from the published description. I would advise you to send to that station for a copy of this bulletin.—[June 28, 1892.]

Coloring Matter of the Plant-louse of the Golden Rod.

Two or three plants of Golden Rod have appeared in my garden, and have been allowed for variety to remain. During the last two years I have noticed immense gatherings of a reddish insect. A kind of ladybird assembled with them, and I noticed that whenever any of the insects were crushed a deep-red fluid remained. As I got the impression that these insects were "Buffalo Moths" I destroyed them. This year, however, they appear again, and now I find myself impressed with the idea that these insects are similar to. if not the actual Cochineal of commerce. As you are aware, the Cochineal bugs feed on the Cactus plant, are scraped off, killed in hot water, dried and sold for dye. This merchandise comes from Mexico. As I can not decide this matter I send you, for inspection, a cluster. I do not know that the ladybird is a progenitor—she may be only a visitor.— * * * [John P. Ellis, Flushing, N. Y., May 10, 1892.

REPLY.— * * * The reddish insect which you notice upon Golden Rod is a plant-louse known as *Siphonophora rudbeckiæ*, and has no connection whatever with either of the insects you mention. The ladybirds which you notice among the plant-lice were feeding upon them. I can not refer you to any published account of any experiments with these bright-colored plant-lice in view of utilizing the coloring matter commercially. Some twelve years ago some experiments in this direction were instituted by the late Dr. W. S. Barnard, then of Cornell University, with this identical species, but they resulted in failure, from what cause we are unaware.—[June 14, 1892.]

NOTES FROM CORRESPONDENTS.

Spread of the Horn Fly.—A correspondent in Uniontown, Pa., writes us that the Horn Fly has made its appearance in that vicinity, having first been noticed last season and having become very abundant the present summer. While spending a few weeks in Greene County, N. Y., we noticed this insect in comparative abundance, but not yet numerous enough to attract attention to the habit of congregating upon the horns. Another new locality has been given us by Mr. J. H. Woodruff, of Watertown, Conn., who has found the fly to be very abundant in his vicinity, and still another locality is Waller County, Tex. We are indebted to Mr. F. W. Thurow for specimens from this region. During the month of August complaints have also come in from quite a number of correspondents, among others from the following: Elisha Slade, Bristol County, Mass.; Miss E. J. Phillips, Cuyahoga County, Ohio; George L. Oliver, Otsego County, N. Y.; Devoe and Shumway, Montgomery County, N. Y.; T. C. Ross, Jefferson County, Iowa; B. F. Koons, Tolland County, Conn.; I. N. Rauls, Citrus County, Fla.

Tent Caterpillars on Hop in Washington.—A species of the genus Clisiocampa, allied to the eastern Tent Caterpillar of the orchard, has been doing considerable damage to the hop vines in one or two localities in the State of Washington, as we learn from Mr. Giles Farmin. In one restricted locality they reduced the crop one-half.

An unusual Occurrence of Cicada.—Our old-time correspondent, Mr. B. H. Brodnax, of Brodnax, La., wrote us last May that he had heard the song of the Periodical Cicada on May 3, and asked us to identify the brood. After a careful survey of the field we arrived at the conclusion that the specimens occurring at Brodnax this year must be the precursors of *tredecim* brood XVIII which is due in that locality in 1894, the last appearance having been in 1881. These precursors or stragglers are not uncommon and we often hear of them one year before or one year after the regular year, but an advance of two years is more unusual and is well worthy of record.

The "Stink Bush."—We recently published a note in INSECT LIFE relative to the insecticide properties of the bush which is known in the Southern States as "Stink Bush." We were unable at the time to give a proper identification of this plant, but through the kindness of Mr. S. B. Mullen, of Harrisville, Miss., we have received specimens, and are able to state that this plant is *Illicium floridanum*. It is an aromatic shrub belonging to the Magnolia family, and is known perhaps more commonly as Wild Anise. We have had as yet only hearsay evidence concerning the insect-killing properties of this species, but have asked Mr. Mullen, in whose vicinity it grows abundantly, and who is fitted for careful work, to conduct some well-planned experiments and to report.

Further Success of Vedalia in Egypt.—Rear-Admiral Blomfield, to whom we sent several consignments of Vedalia for use against Egyptian Fluted Scale, and whose letters announcing the success of the later consignments we have published from time to time, has written us that the beneficial Australian insect has recently made its appearance in a garden in Ramleh, a distance of more than three miles from the original trees upon which the first specimens were reported. The experiment is evidently turning out very successfully.

The Colorado Potato-beetle in the South.—We received in the early part of the season specimens of the Colorado Potato-beetle from Port Royal, S. C., with the report that they are abundant and threatening damage. We wrote the correspondent, Mr. H. D. Elliott, that the locality was too far south to anticipate much injury, that the insect had made sporadic appearances at different points in the same locality, and had disappeared almost immediately, so that he had not much to fear. Within a month from the date of our communication the insect disappeared and it has not been seen since.

The Rascal Leaf-crumpler in Texas.—This insect, which frequently does great damage to orchard trees, has recently made a most destructive appearance in the vicinity of Houston, Tex., a locality from which it has not heretofore been reported in numbers.

Extraordinary Abundance of the Oak Pruner.—Mr. Jno. B. Watson, of Philadelphia, has sent us specimens of twigs of Black Oak from Bucks County, Pa., which have been cut off in great numbers by the Oak Pruner (*Elaphidion villosum*). Mr. Watson writes that cartloads of branches can be gathered up from the ground through the oak forests. We do not remember to have known this insect to be so abundant before. The remedy, however, is simple, and if the fallen branches are collected and burned at this time of the year, or later, the forests will not be harmed to anything like the same extent next season.

The Stalk-borer on Cotton.—That widespread and polyphagic insect, the Potato or Tomato Stalk-borer (*Gortyna nitela*), has recently been doing considerable damage to Cotton in the vicinity of Macon, Tenn. While this destructive species has been reported as affecting almost every cultivated plant which has a stalk big enough to be bored, we have never known it to be injurious to Cotton before to any extent.

A new Locality for Gossyparia ulmi.—Mr. C. H. Rowe, of Malden, Mass., has sent us specimens of this interesting imported European bark-louse which he found upon the underside of the limbs of an elm tree at Brighton, Mass. It will be recollected that Mr. Howard treated this insect in Vol. II, pp. 34 to 41, and that it has been previously found in Boston, New York, and Washington.

Dr. Hulst's Collection of Lepidoptera.—We learn from Dr. Geo. D. Hulst that he has donated his collection of Lepidoptera to Rutgers College. The collection is reported to be very rich in Catocala, as we know it to be in the Geometrina and Pyralidina, two groups in which Dr. Hulst has more particularly worked and which he retains for the present in Brooklyn.

GENERAL NOTES.

SUGAR-CANE PIN-BORER AND CANE DISEASE.

We have just received from Mr. J. M. Hart, F. L. S., of the Royal Botanic Gardens of Trinidad, a stylographic circular on the sugar-cane disease and its relation to the Pin-borer, *Xyleborus perforans* Woll.,* together with the following letter of transmittal. The circular is published entire, as it is a matter concerning which we have had considerable to say of late in these pages.

ROYAL BOTANIC GARDENS, *Trinidad, July 12, 1892.*

* * * I have the honor to send you a few notes on our cane disease, which I think perhaps will interest you. I was one of those on the original committee of the agricultural board of Trinidad, who thought that the Xyleborus was altogether to blame. Subsequent investigations under the microscope showed that the canes, or most of them, were first subject to the attack of a microscopic fungus, and that the attack of the beetle was subsequent to the attack of the fungus, until the numbers so increased that the insect had for very life's sake to feed upon the nearest available food, *i. e.*, healthy canes. I am one of those persons who, from many years of experience in the cultivation of plants, have come to the conclusion that plants in a weak state, from whatever cause, are liable to the attacks of insects more than those in a healthy state, and that it is the weakness of the plant that invites the insect attack. Plants, it is true, may be attacked when healthy and rendered unhealthy, but the chances are that if in robust health they are well able to fight their insect enemies, and to survive their attack or rather outgrow them. Insect attacks, I believe, often spread and become epidemic in character among healthy plants, after they have been introduced and allowed to increase in abnormal numbers on unhealthy plants

Our canes here have suffered from an alternation of dry and wet years, and as a matter of fact, our sugar-planters never dream of an alternation, but plant cane, generation after generation without change of even the variety cultivated or of the stock with other estates. For long years this has answered, but, though brought up by manures to a state of apparent "vegetative vigor," the canes are actually constitutionally weak and liable to insect and fungus attack in unfavorable seasons. The Xyleborus has appeared and is credited with the mischief, simply because the first cause (fungus) was unsuspected and unknown and unseen.

---

*In recent numbers (vol. IV, pp. 342 and 402) we published notes on what is probably the same insect, viz, *X. pubescens* Zimm. In our first note the species was, through a clerical error, incorrectly referred to as "*X. piceus* Zimm."—EDS.

CIRCULAR.

CANE DISEASE.

In canes from fields which have this year been seriously attacked by the Pin-borer, *Xyleborus perforans* Woll., there has also been observed the mycelium of an unknown microscopic fungus. The attack of this fungus appears in most cases to precede the attack of the borer, and may be known to exist whenever the "red stain" or patch is found to be present. This fungus permeates the cells of the cane, especially at the node, and the affected cells soon give rise to the stain referred to. The Xyleborus entering such fungus-infected canes soon completes their destruction. Prof. D. Albuquerque, of Barbados, reports that he is able to confirm the presence of the fungus, and after a further examination, at my suggestion, he has accumulated evidence that the fungus is the original cause of the mischief. He also records that the Bourbon cane is the greatest sufferer.

T D. A. Cockerell, Esq., of Jamaica, says: "From the known habits of the Xyleborus he should expect it to attack canes severly injured in any way by moth, weevil, fungus, or mechanical means." Prof. C. V. Riley, United States Entomologist, says he feels "reasonably sure that the Xyleborus is not the culprit." Mr. Cockerell has found on affected canes from Barbados and Jamaica a new species of fungus, which it is proposed to call *Trullula sacchari*. Specimens of infected canes kept under different conditions in Trinidad have also developed one or more species of fungi. The appearance of the fungus on one specimen is very similar to that of the well known *Puccinia granarius* or Wheat Rust. The connection of these fungi with the mycelium of the fungus which permeates the cells of our canes is, however, not yet clearly established. Specimens have been sent for the determination of specialists in this branch, and their reply is awaited with interest. If it be shown that these fungi are of the same character as Puccinia a step will be gained, from the fact that that fungus is known to develop in alternate generations on different plants. At one season and in one form on the Barberry and at another season and in another form on Wheat, and we may thus infer that the host plants of our fungus may be found in proximity to each other, and this opens the possibility of our being able to destroy them during some period of their development.

The serious nature of the attack should incite our planters to an endeavor to mitigate the evil as much as possible, by taking care to burn all cane refuse of every kind clean off the fields, and not leave a single particle of vegetable matter in which either the fungus or the beetle could develop.

The greatest pains should be taken also to change the kind of canes cultivated for those of other districts, and as far as possible to cultivate the land alternately with different crops.

NOTES FROM THE JAMAICA MUSEUM.

We have previously noticed an interesting series of stylographic circulars issued by Mr. T. D. A. Cockerell, Curator at Kingston, Jamaica. We are in receipt of Nos. 8, 9, 14, and 15 of the series, and find in them much matter of interest. No. 8 is devoted to the consideration of the deceptive resemblances in nature; No. 9 to the St. Andrew's Cotton Stainer (*Dysdercus andreæ*), which we have already mentioned as taking the place of our Red Bug or Cotton Stainer (*D. suturellus*) in Jamaica; No. 14, Scale-insects from Antigua, and No. 15, Sugar-cane pests in Trinidad and Barbados. In No. 9 Mr. Cockerell suggests as remedies for the Cotton Stainer to destroy the wild, native food-plants in the neighborhood of the crop to be protected and to make heaps of the sugar-cane

refuse, cotton seed, etc., to which the insects will be attracted in numbers, when they may be killed by drenching them with hot water. This is an old remedy, recommended by Glover many years ago. In No. 7 seven species of scale-insects are mentioned, while in No. 15 some little consideration is given to the subject of the new Sugar-cane Pin-borer, to which we have just referred in these pages. Mr. Cockerell agrees with us that the insect is not a prime cause of damage to the sugar cane, but follows injury due to other causes.

AN EXPLODED REMEDY FOR THE PLUM CURCULIO.

We are surprised to notice still going the rounds of the press an account, often with editorial indorsement, of a curculio remedy which has long since been proved unavailing. It consists in tying corncobs soaked in molasses on the branches of the tree to be protected, and the theory is that the insect will lay its eggs in the sweetened corncobs in preference to laying them in the fruit!

Another of these utterly worthless pseudo-remedies which, we regret to say, has found space in some of our most valuable journals, is of practically the same nature, except that in place of corncobs the writer advises the use of tomato cans filled with a mixture of molasses, vinegar, and water.

Those of our readers who are interested in this subject are referred to our Annual Report for 1888, where will be found sixteen pages (pp. 64–79) devoted to remedies for this pest.

GOOD WORK OF THE TWICE-STABBED LADYBIRD.

The *California Fruit Grower* has published the statement that Mr. N. W. Motheral procured in 1890 a number of specimens of *Chilocorus bivulnerus* in San Diego County, and placed them in some orchards in Tulare County which were infested by the San José Scale (*Aspidiotus perniciosus*). They did not appear to multiply greatly until last spring, when immense numbers appeared simultaneously and completely cleared the orchards of Tulare County of the scales; trees which had not been sprayed being as completely cleared as those which had been sprayed.

NOTES ON OHIO COLEOPTERA.

We have received from our esteemed correspondent Mr. Charles Dury, of Cincinnati, Ohio, a consignment of specimens, mostly Coleoptera, for the collection of the U. S. National Museum. The following abstract from his correspondence is of special interest as bearing on the life-habits of Coleoptera:

In regard to *Valgus*, we always take *canaliculatus*, by beating vegetation, mostly Haw Apple, while we always find *squamiger* under bark or about dead timber—the form with the prolonged pygidium is always found on dead timber. I never examined this pygidium, but supposed it was a protruded ovipositor. I see on looking closely that it is a prolongation of the pygidium. * * * In regard to the supposed larvæ of *Dryops*, they were from a small stream in Kentucky and found adhering to sub-

merged twigs in company with *Dryops fastigiatus*. So we supposed they were the larvæ of that species, as no Psephenus ever occurred there that I know of.

Saperda calcarata is playing havoc with the Silver Poplar here. They attack the trunks and bore them full of holes, which weakens the tree, and at the first wind-storm the top breaks off at the point. I was out yesterday and beat a number of *Clytanthus albofasciatus* from Wild Grape-vine, and as this was one of your desiderata, I have set aside a pair for you.

THE CLOVER-LEAF WEEVIL IN OHIO.

This insect has been spreading southward since we first treated it in 1882, but has not extended its work to the West as rapidly as might have been expected. In Newspaper Bulletin No. 93 of the Ohio Experimental Station Mr. Webster records it from Lake and Portage Counties, Ohio, and where it seems to have appeared in sufficient numbers to do some damage. We have not before noted the fact that for several years this insect has been very abundant in the vicinity of Washington, D. C. Nothing in the way of remedies seems to have been discovered since the publication of our article in 1882. Where the stubble can be burned during the winter the numbers of the insect can be greatly reduced, but plowing under during May, although it necessitates some loss, will be the most efficacious remedy.

THE JAPANESE GYPSY MOTH AND ITS PARASITE.

It will be remembered that we have been in correspondence with the Rev. H. Loomis, Yokohama, in reference to a Microgasterin parasite of the Gypsy Moth of Japan, which latter he supposed to be identical with the same species which is creating such great havoc in Massachusetts at present. The parasite proved to be a new species of the genus Apanteles, and on the occasion of a recent visit to this country Mr. Loomis brought specimens with him in the cocoon state, which were turned over to the Gypsy Moth Commision. None of the adult parasites emerged, so far as we have been able to learn. Mr. Loomis called upon us in Washington and we urged him to send specimens of the host insect. This he has recently done, and it turns out that the Japanese Moth is, as we suspected, and as Mr. W. F. Kirby conjectured in an early number of INSECT LIFE, different from the European species which has been introduced into this country. The Japanese species is *Ocneria japonica*. It is a larger insect than the Gypsy Moth of Massachusetts, but is so closely related that there is every reason to suppose that this parasite will affect our species. This is all the more likely to be the case as the parasites of the genus Apanteles seldom confine themselves to a single species of host insect, while many of them are very general feeders. In fact, we anticipate that some of our native congeneric species of this genus will acquire a taste for the imported caterpillar.

A NEW SUGAR-BEET PEST.

An interesting addition to Mr. Lawrence Bruner's list of sugar-beet insects has come to the front this summer on the grounds of the Sugar Beet Station of the Chemical Division of this Department at Schuyler, Nebr. In the third week in July the experiment plats were found to be badly "ragged" by a small dark-green caterpillar of great activity and voracious appetite. Experiments with different insecticides were immediately instituted by Mr. C. B. Edson, who was temporarily in charge of the work during the absence of Mr. Walter Maxwell. Paris green, Persian insect powder, and white hellebore were tried, with varying results. Specimens of the insect were forwarded to Washington. The moth has not yet been reared, and the caterpillar is new to the national collection. It bears a close resemblance to the Garden Web-worm (*Eurycreon rantalis*=*Loxostege similalis* Gn.), which in 1885 damaged cotton, corn, and different garden vegetables in Kansas, Colorado, Nebraska, Texas, and the Indian Territory, and which we treated at some length in our annual report for that year. The sugar-beet larvæ, however, are darker in color and differ somewhat in the arrangement of the tubercles, but will probably prove to belong to the same genus. In fact, in August Mr. Maxwell sent us specimens of *Loxostege sticticalis* L., which were flying in great numbers and resting on the under sides of the beet leaves, and which will in all probability prove to be the adult of the injurious caterpillar. Unless Mr. Edson's remedial work has been very complete another generation will probably appear the present summer, and we will endeavor to give a detailed account before the close of the season.

THE LARVAL HABITS OF *Thalpochares cocciphaga*.

This interesting little Noctuid moth, which has been imported from Australia on several occasions through Mr. Koebele's assistance, is, as will be remembered by those who have read Bulletin 21 of this Division, an important enemy of the Black Scale in Australia. Mr. Koebele's 1888 sendings were unsuccessful, as the specimens all died after their receipt in California. Recently, however, many other specimens have been received in good condition, and have been carefully placed in advantageous positions upon infested olive trees at Los Angeles. The following extract from a letter recently received from Mr. Coquillett gives an interesting account of the larval habits, but is discouraging in view of their expected efficacy against the Black Scale:

Several days ago I removed about a dozen larvæ of *Thalpochares cocciphaga* from their cocoons and placed them in a box upon some twigs thickly infested with Black Scales. Although the prolegs of these larvæ are abortive, they are furnished with hooks at the tip, and the larvæ are able to crawl about, but they move very slowly and do not use the last, or anal, pair of prolegs, but hold the posterior end of the body slightly elevated above the surface upon which they are crawling. These larvæ are very pugnacious, and whenever two of them meet a fight is almost certain to occur,

each trying to seize with its mandibles the mouth-parts of the other. Occasionally one would thus seize one of the mandibles of its opponent, and would shake the head and forepart of the body of the latter from side to side, somewhat as a terrier shakes a rat, and sometimes his jaws would lose their hold and come together with such force as to produce a distinct clicking sound. They never attack the soft parts of the body, the objective point being the mouth-parts, and these do not appear to become injured in these attacks. Size does not count for much, since a small larva will, without the slightest hesitation, attack one that is twice as large as itself. They appear to enjoy these fights very much; I have seen two of them fight almost continuously for fully ten minutes. Sometimes three of them would be thus engaged, two at a time, changing around so that neither of them would be idle for any great length of time. They do not appear to be very great feeders. During the past four days the above larvæ have devoured only a portion of the Black Scale.

The following is from a later communication (July 11):

I have finally succeeded in obtaining fertile eggs and young larvæ of *Thalpochares cocciphaga*. The egg is turnip-shaped, about twice as broad as high, and with a deep concavity on the upper end, in the center of which is a rounded tubercle; the surface is covered with raised lines forming shallow cells of various shapes and sizes. The eggs are deposited singly. The recently hatched larva, like the full-grown one, is provided with only two pairs of abdominal prolegs, these being on the eighth and ninth segments. The moths remain at rest during the daytime, and become active early in the evening. I have now quite a number of these moths, so that the introduction of this species into California is pretty well assured.

LOCUSTS IN ALGERIA.

We have already published a notice of the locust invasion of Algeria during the past two or three years, and have briefly described the methods employed by the French Government to check their ravages. From a press clipping dated May 19 it appears that the locusts are returning this year in greater numbers than ever, and it is now thought that they come clear across the desert from the Soudan. Great clouds of the locusts, sufficiently numerous in places to fairly darken the sun, have already been seen on the northern edge of the Sahara, and it is believed that they have journeyed northward from the Niger River, in the Soudan, where, about a month before, similar clouds of the insects were reported.

CHANGES OF COLOR IN *Schistocerca peregrina* OL.

In the "Bulletin des Séances de la Société Entomologique de France" for January 27, 1892, M. Künckel d'Herculais, whose investigations in Algeria of the Migratory Locusts of Africa we have previously alluded to, has an article upon the changes of color which *Schistocerca peregrina* Oliv. undergoes after attaining maturity. Since the inquiry of M. Selys-Longchamps in 1877, on the European appearances of migratory locusts, it has been generally held that *S. peregrina* is represented by two varieties, the one yellow, originating in the north of Africa, and the other rose-colored and originating in Senegal. Olivier himself, in his original description of the species, remarks upon this rose-colored

variety, which has been figured by Audinet-Serville (1839) and described since that time by a number of observers of the insect invasions of Algeria. M. d'Herculais, however, says that his observations establish the fact that all the changes of color which are observed in this species—*i. e.*, from rose-colored to red, to gray, to sienna, to citron yellow—mark so many stages of growth, and serve as a criterion to determine, first, the origin of the invasion, and second, the period when the first egg-laying may be accomplished. For instance, the locusts described in December in the extreme south were of a carmine red; they were hatched at least a month before; they were developed at a distance of at least thirty days' march. They would take several weeks to assume the yellow tint, and could not lay eggs until two months, at least, had gone by. When they had assumed the sienna color pairing and copulation began; when the yellow stage was reached, pairing and copulation were renewed. There may be pairing between yellow males and sienna-colored females, and *vice versa*. The red-colored locusts, which do not pair, and the females of which, consequently, do not lay eggs, are those which the inhabitants of the Sahara gather and eat. The action of light upon the changes of color is very marked; young locusts raised in the shade do not exhibit the vivid colors of their brothers who have lived in the full light of the sun. From these changes of color, M. d'Herculais suspects the presence of zoönerythrine, a red pigment discovered by Merejkowsky in many invertebrates, notably among the Crustaceans, but not described as occurring in insects. It is a substance which corresponds to the hemoglobin in vertebrates.

"GRASSHOPPERS" IN THE EAST.

The extraordinary abundance of local non-migratory locusts, or "grasshoppers," in different parts of the country last year led us to expect reports of similar occurrences the present season. Up to the present time, however, comparatively few such reports have been brought to our attention. The first notice was in the *St. Louis Republic*, June 17, where it was reported that at Washington, Miss., one planter is stated to have lost 200 acres of cotton through grasshoppers.

No further reports were heard until, during the first part of August, the hoppers made their appearance in the gardens of Hagerstown, Md., making havoc with sweet corn and other garden vegetables. About the same time a number of reports came in from western Pennsylvania. The *Newcastle News* of August 6, the *Lock Haven Express* of August 9, the *Pittsburgh Leader* of August 11, the *Pittsburgh Despatch* of August 17, the *Mauch Chunk Times* of August 15, a West Newton journal of August 11, the *Washington Observer* of August 12, the *Leechburgh Advance* of August 12, and the *Greensburgh Press* of August 16, all contained items announcing that considerable damage was being done to the oat crop in their respective neighborhoods. The

Pittsburgh Despatch of August 17 contained an interview with Dr. John Hamilton, who stated that the abundance of grasshoppers in the vicinity of Pittsburgh was due to the extended drouth, hardly a drop of rain having fallen since July 3. The second week in August wheat and oats in the vicinity of Newark, Ohio, were damaged, and corn near the lower end of Seneca Lake, N. Y.

THE BOT-FLY OF HUMAN BEINGS.

Apropos of our editorial review of Prof. Blanchard's summary of the Oestridæ which burrow beneath the skin of man, we may mention an interesting communication which we have just received from Mr. David Logan, now connected with the Gypsy Moth Commission, of Massachusetts. Mr. Logan writes us that he has been familiar with the species having this disagreeable habit, first in Honduras on the Rio Tinto, but more abundantly on the Rio Magdalena, near Mompos and upon the River Sinu, 30 leagues south of Carthagena, in the United States of Colombia. In his ninteen years' experience in tropical forests he estimates that he has had at least a hundred of these parasites in different parts of his body and at one time had eighteen of the maggots squeezed out of his back. He had been for weeks in the woods hunting mahogany, and there were neither cattle nor people anywhere around. It was, in fact, in a perfect wilderness. He is in doubt as to whether the eggs are laid on the skin or upon the bushes and come off upon the clothing of people passing. Naked Indians, he states, had not one-tenth as many as whites who wore shirts.

Mr. Logan further states that the natives believe that the grubs are produced by a species of yellow mosquito, and have named the larva *gusano de mosquito*. The back and shoulders of human beings appear to be specially subject to attack, although the *gusano* sometimes shows itself in other places, and Mr. Logan was once attacked in the upper lip. The first evidence of the presence of the grubs in the skin is the appearance of a little swelling resembling a small boil, not painful, but giving to the victim a feeling of uneasiness. On close observation a minute orifice may be seen in the center of this swelling. When first detected the larva is usually of about the size of a pinhead. It works chiefly at night and not continuously, but intermittently. Mr. Logan had never kept specimens in his person for study or experiment, but at one time had one for about six weeks in his shoulder. It was at this stage at least an inch long when contracted, and when elongated about an inch and a quarter in length. There were rings around the body apparently covered with minute hairs or spinules, the body being narrowed at the ends and much thicker than the head. The common remedy adopted was to place a piece of leaf tobacco over the perforation in the skin, and soon after the maggot could be squeezed out.

As to the deposition of the eggs we have information from other ob-

servers that the flies have been seen to oviposit on the skin, and it is easily conceived that the young grubs will more easily travel and get purchase to enter the skin where persons are clothed than otherwise. The absence of cattle or people from the locality on the Sinu is not necessarily an argument in favor of oviposition upon vegetation, since the insects may, and undoubtedly do, breed in wild animals. It is likely that the species concerned is *Dermatobia noxialis*, commonly known in the Spanish Americas as *Ver macaque.*

A NEW TABANID.

In *Psyche* for March, 1892, Mr. J. M. Aldrich, of Brookings, S. Dak., describes a new genus and species of Tabanidæ, *Goniops hippoboscoides.* The general appearance of the fly is that of a particularly fine, large, silvery Hippoboscid with brown wings, but an examination showed it to be a true Tabanid. Its habits are stated to be unknown, but from its appearance the conclusion is probable that it lives like a Hippoboscid upon some bird or mammal Figures of the adult fly, of a side view of the head and of an antenna, are given.

THE CHINCH BUG IN ILLINOIS, 1891-1892.

Under the above caption Prof. S. A. Forbes presents an interesting article in Bulletin 19 of the University of Illinois Experiment Station (pp. 44-48). He refers to the almost uniformly high temperature of the past two summers (1890-1891), accompanied with a very small rainfall, in northern and central Illinois, which favored unusually the development of the Chinch Bug in these sections, and make it reasonable to expect considerable loss for the present summer should similar conditions prevail.

The facts concerning the distribution of the Chinch Bug in the central counties of the State are given, and also for the center of the northern or rather northeastern counties of the State, where the prospect for further injury is more serious. The facts brought out show that the cereal crops of a considerable part of Illinois are in danger in the immediate future unless the conditions of the weather are very unfavorable to the multiplication of the Chinch Bug.

The article concludes with a summary of the practical measures of defense, consisting in the destruction of the bugs by fire before they leave their winter quarters; the support of the infested crop by the use of fertilizers; the destruction of the insect in small grains when they appear very abundantly in patches; arresting their movements and destroying them as they pass from field to field at harvest, and taking steps to promptly disseminate their natural contagious diseases.

Referring to the latter measure, he says that the subject of the use of contagious insect diseases is still in the experimental stage, the relation of this method to various weather conditions being as yet particularly

doubtful. He adds, however, that its promise is such as to make it well worth while for anyone interested to try the experiment thoroughly and carefully, and he offers to supply material for infection to anyone desiring to experiment.

THE MEALY BUG DAMAGING COFFEE IN MEXICO.

Among the many applications which we have received, since the successful introduction of Vedalia into California, for specimens of this beneficial insect, to be used against other scales in different parts of the world, none has been of more interest than one recently received from Señor Juan N. Navarro, Mexican consul-general in New York City. Señor Navarro wrote us at the request of the Governor of the State of Michoacan for specimens of Vedalia for use against a scale insect which is damaging the coffee crop in that State. We replied that Vedalia was of practical benefit against Icerya only, and that we very much doubted whether any good could be accomplished by sending it to Mexico. We requested, however, specimens of the scale-insect damaging coffee, and have recently received a number in alcohol, which indicate that the species doing this damage is our common green-house Mealy Bug (*Dactylopius destructor*). We have advised the use of the kerosene emulsion spray against this important pest.

THE HOP PLANT-LOUSE IN WASHINGTON.

The latest advices from the State of Washington indicate that the Hop Plant-louse has made its appearance in numbers upon the hop vines. Hop-growers are spraying very extensively, different mixtures being used. The principal are the kerosene emulsion, the whale-oil soap emulsion, and the quassia decoction. A machine known as the roller sprayer has been extensively used, with much success. Since the publication of Prof. Washburn's very satisfactory defense of kerosene emulsion, we have seen less of the opposition to this substance.

TICKING OF THE BOOK LOUSE.

Mr. C. J. Gahan, in exhibiting specimens to the Entomological Society of London of the common Book Louse, *Atropos pulsatorius* Fabr., stated that he had heard it making a ticking noise similar to that made by the "death watch" (Anobium). We put this on record as corroborative evidence of the power of making such noise possessed by Atropos, which many have felt doubtful of on account of its minute size and soft body covering.

DELTOID MOTHS.

Prof. J. B. Smith, New Brunswick, N. J., is engaged on a monographic revision of the Deltoid group of the Noctuidæ and desires material from all parts of the country. He will name and return all

material sent him for the privilege of retaining such specimens as may be needed for description or for completing the collection of the U. S. National Museum. We earnestly hope that those of our readers who are sufficiently interested will, by complying with this request, help themselves, Prof. Smith, and Lepidopterology; for every encouragement should be given to those who have the time and the ability to do good monographic work, which is the chief means by which our science is advanced along systematic lines.

PHÆISM IN INSECTS.

In connection with the exhibition of dark specimens of *Zygæna minor*, at a recent meeting of the Entomological Society of London, which were not representatives of complete melanism, Mr. J. Jenner Weir suggests the use of the word phæism as a correct term to apply to such departures from the normal coloration of the species.

CAUTION TO HOP-GROWERS.

Apropos of what has recently been said in these pages regarding the superiority of the kerosene emulsion over the quassia chips, we quote the following editorial from the *California Fruit Grower* of August 6:

> Smooth agents are said to be reaping quite a harvest from the Washington hop-growers in the sale of quassia chips and other alleged remedies for the Hop Louse. Hop-growers would do well to seek such information as they need from responsible sources, such as the experiment stations, or reputable journals, rather than give their confidence and good money to wholly irresponsible traveling agents.

A NEW SIMULIUM.

A new Simulium allied to the notorious Buffalo Gnat of the South is reported from southern New Mexico by Mr. C. H. T. Townsend, who states that it breeds in the Rio Grande, issuing during May and June. These gnats are a great annoyance to man, more so apparently than to animals, and many persons are stated to be so susceptible to them as to preserve through the gnat season a chronic inflammation of the exposed parts of the face and neck resulting from the repeated bites which in some instances give rise to sores. The inclination of the gnats to flight increases with the advance of the season, but they disappear with the falling of the water to its normal level in the rivers. The habits and early stages have not been investigated, and the female fly, comprising the biting swarms, only has been studied. The species is described as *Simulium occidentalis*.

NOTES ON ECONOMIC ENTOMOLOGY.

Entomological News for September (vol. III, pp. 181–183) has just reached our table as we go to press, and we are pleased to notice a departure in the establishment in this number of a new department, that of Economic Entomology.

In accordance with the lines laid down at its inception, this journal has been devoted mainly to subjects of general interest to the collector and student of insect life, and in particular to short articles and notes, news items, doings of societies, etc. It is to be hoped that the new department will be a valuable and permanent one. Under the general heading, "Notes on Economic Entomology," abstracts are given on the following topics of economic interest: Mr. Bruner's remarks on the cornmeal remedy for Cabbage Worms, as published in Bulletin No. 27 of this Division; potassium iodide for bee stings; soapsuds for Cabbage Lice; a curculio remedy; and a short note contributed by Mr. Wm. J. Fox on the occurrence of *Calandra remotepunctata* in stored Barley. Mr. Fox is in error, however, in assuming that this species has not heretofore been noticed as attacking grain, as we have in mind several published records of this habit. B. D. Walsh (Journal Ills. State Agr. Soc., January, 1862) remarks on the occurrence of this species in Wheat. W. E. Saunders (Can. Ent., vol. XV, p. 81) cites an instance of the larvæ feeding on Pearl Barley. Dr. John Hamilton (Tr. Am. Ent. Soc., vol. XVI, p. 158) states that the species depredates on grain. Walsh's article was also reprinted in 1863 (Proc. Bos. Soc. Nat. Hist., vol. IX, p. 311).

ANNUAL MEETING OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO.

The twenty-ninth annual meeting of the Entomological Society of Ontario was held at London, Ontario, August 31, 1892. President C. J. S. Bethune gave the opening address, and, in speaking of the principal insect damage of the year, made special mention of the following species: Eye-spotted Bud Moth, Zebra Caterpillar, Cabbage Root Maggot, Pear-leaf Blister Mite, Fall Web-worm, Grape-vine Flea-beetle, Clover Root-borer, Wheat-stem Maggot, the Horn Fly, besides cutworms, canker-worms, and grasshoppers. The Horn Fly has probably been the most formidable of all the pests mentioned. The following officers were elected for the ensuing year: President, W. H. Harrington; vice-president, J. M. Denton; secretary, W. E. Saunders; treasurer, J. A. Balkwell; librarian and curator, J. A. Moffat. Rev. C. J. S. Bethune was reëlected editor of the *Canadian Entomologist*.

LIST OF THE PERSONS ENGAGED IN GOVERNMENT ENTOMOLOGICAL WORK.

The following list embraces those now engaged in Government entomological work. The force of the Division of Entomology is more or less inconstant, as it consists of both permanent and temporary employés. Illustrations to this Bulletin, where not otherwise stated, are drawn by Miss Lillie Sullivan, under supervision.

DIVISION OF ENTOMOLOGY, U. S. DEPARTMENT OF AGRICULTURE.

Entomologist: C. V. Riley.

Office Staff: L. O. Howard, First Assistant; E. A. Schwarz, Th. Pergande, C. L. Marlatt, F. H. Chittenden, W. H. Ashmead, A. B. Cordley, Assistants.

Field Agents: Herbert Osborn, Ames, Iowa; Lawrence Bruner, Lincoln, Nebr.; D. W. Coquillett, Los Angeles, Cal.; Albert Koebele, Alameda, Cal.; Frank Benton, Detroit, Mich.

DEPARTMENT OF INSECTS, U. S. NATIONAL MUSEUM.

Honorary Curator: C. V. Riley.

Aid: Martin L. Linell.

U. S. DEPARTMENT OF AGRICULTURE.

DIVISION OF ENTOMOLOGY.

PERIODICAL BULLETIN. Issued November, 1892.

Vol. V. No. 2.

INSECT LIFE.

DEVOTED TO THE ECONOMY AND LIFE-HABITS OF INSECTS, ESPECIALLY IN THEIR RELATIONS TO AGRICULTURE.

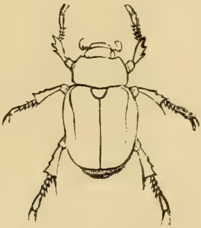
EDITED BY

C. V. RILEY, Entomologist,

AND

L. O. HOWARD, First Assistant,

WITH THE ASSISTANCE OF OTHER MEMBERS OF THE DIVISIONAL FORCE.



[PUBLISHED BY AUTHORITY OF THE SECRETARY OF AGRICULTURE.]

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1892.

CONTENTS.

SPECIAL NOTES.

The Association of Economic Entomologists.—The larger part of the present number is taken up with the Proceedings of the Sixth Meeting of the Association of Economic Entomologists, held in connection with the meeting of the American Association for the Advancement of Science, at Rochester, N. Y., August 15 and 16 last. These proceedings are published in accordance with a resolution of the Association requesting their publication in INSECT LIFE. The papers are mostly by station entomologists and, with the discussions, will be found of much practical and scientific interest. The Association is strong and successful, and has, we hope, a long and important life before it.

Agricultural Gazette of New South Wales.—Part 6, vol. III, of this publication, issued June, 1892, contains, under the head of Entomological Notes, by A. Sidney Olliff, some account of the Cherry Tree Borer (*Cryptophasa unipuncta* Don.) at Blackheath; the introduction of the fig insect, *Blastophaga psenes* Linn., into Australia; and a walking-stick insect destroying forest trees. Under the head of the introduction of the Blastophaga, Mr. Olliff quotes a resolution by the Australian Association for the Advancement of Science, passed at the meeting held at Hobart in January, 1892, to the effect that the Association recommends that steps be taken to introduce the Caprifig and the fig insect from Smyrna. Mr. Olliff then quotes at length from the opinions of Mayer and Solms-Laubach and from the account of Mr. Eisen of the efforts to introduce *Blastophaga psenes* into California, recently published in INSECT LIFE. He states that both the Smyrna fig and the Caprifig already grow in certain localities in New South Wales, and concludes that it will be well to follow the example of California and introduce the Blastophaga, as well as to conduct experiments with the native Australian fig insect, *Pleistodontes imperialis* Saund. For the second time since our account of the damage done to forest trees in northwestern New York by the "walking-stick," *Diapheromera femorata*, in 1878, a species of this family has been reported as doing extensive damage to vegetation. Mr. Olliff's notes give an account of the extraordinary increase of *Acrophylla tessellata* in New South Wales.

Four hundred acres of trees—Oak, Turpentine, Ironwood, Bloodwood, and Gum (in the order named)—have been entirely denuded the present season. The remedy used was to jar the insects from the trees and crush them on the surface of the ground. In the New York case it will be remembered that we found that the insects dropped their eggs upon the ground, where they were easily destroyed by burning over the leaves. The only other occurrence of this character which we recollect to have seen was noted by Mr. Olliff in the same journal for June, 1891. In this case the species was *Podocanthus wilkinsoni.*

Transactions of the New Zealand Institute for 1891.—The Transactions and Proceedings of the New Zealand Institute for 1891, volume XXIV, Wellington, May, 1892, have just reached us in the form of a large volume of 755 octavo pages. The volume posesses special interest from an entomological standpoint since it contains a further installment of Mr. Maskell's important "Coccid Notes," a communication describing new species of Lepidoptera by E. Meyrick, a catalogue of the described species of New Zealand Araneidæ by A. T. Urquhart, with descriptions of new species of Araneæ by the same author, and a paper on instincts of insects by G. V. Hudson.

Mr. Maskell's paper covers some 65 pages and is illustrated by thirteen carefully executed plates. A number of new species and genera are described and all the new forms are carefully figured. The paper is accompanied by a partial bibliography and also by a most interesting description of Mr. Maskell's mode of systematic investigation, giving an account of his method of preparing specimens for study. We regret to notice that he still retains his eccentric terminations for his larger groups. The reported proceedings of the seven local societies which together compose the Institute indicate a vivid interest in scientific matters in New Zealand. The discussions of the Wellington Philosophical Society are reported in a particularly full manner and indicate that among the members of the society there are many men of broad scientific information.

Insects injuring the Cabbage in Mississippi.—Mr. H. E. Weed, of the Mississippi Station, publishes in Bulletin 21 of the Station (June, 1892) an illustrated account of the insects which he has found injuring cabbages in the State of Mississippi. Twelve species, ranging from the Imported Cabbage Worm to the Wavy-striped Flea-beetle, are mentioned, and the principal point of economic importance which is brought out relates to the remedies for the Harlequin Cabbage Bug. Mr. Weed has followed out the idea, which he was the first to suggest, of killing the

early generations of this insect upon mustard or radish plants by the application of pure kerosene or a very strong kerosene emulsion, and now advocates the planting of a strip of mustard through the field which is to be devoted to cabbages. The insects will congregate upon the mustard and may easily be destroyed in the way mentioned. Mr. Weed elaborated this idea still further and summarized the life history and literature of this insect in a paper read before the Society for the Promotion of Agricultural Science at its Rochester meeting, August 16.

Entomology in Trinidad.—We have received two numbers of a publication entitled "Journal of the Trinidad Field Naturalists' Club," which has been sent to us by our correspondent, Mr. H. Caracciolo, of Port of Spain, the president of the club. No. 3, vol. I, August 1892, contains a number of notes of entomological interest, the most important one being a case of the larvæ of *Lucilia hominivorax* in the nostrils of a woman, reported by a resident physician of Port of Spain who signs only his initials. Mr. Caracciolo brings together a long series of notes on different insects, mainly compiled from American sources; Mr. J. Edward Tanner contributes a note on the Leaf-cutting Ant, *Œcodoma cephaotes*, and Mr. W. F. Kirby, of the British Museum, describes a new butterfly from Trinidad, *Tithorea flavescens*. The number immediately preceding contained several entomological notes, the principal article being a draft of a report by the committee of the club upon the small sugar-cane borer, which we hope to refer to at length in a summary of the habits of and literature concerning this important Scolytid. We are much pleased to see this evidence of activity among the residents of the British West Indies in the direction of entomology. The field is a most interesting one and almost unexplored.

Scale-insects in New Mexico.—As Bulletin 7 of the New Mexico Agricultural Experiment Station, Prof. C. H. Tyler Townsend publishes an account of the scale-insects which he has studied in that State. The paper includes a section on the classification of scale insects, another upon their general habits, one on parasites and other enemies, and a long account of remedies. Ten species receive detailed consideration, the new ones being a new species of *Aspidiotus* on *Chilopsis saligna*, a new species of Lecanium upon Robinia to which we have given the manuscript name of *Lecanium robiniæ;* a new species of the same genus upon Peach, which Prof. Townsend has popularly designated as the Soft Peach Scale, a new Lecanodiaspis on Yucca, which we have called in manuscript *Lecanodiaspis yuccæ*, and a new genus and species upon Mesquite. The three plates are reprinted, from electrotypes derived from this Division.

Department of Agriculture of British Columbia.—In the First Report of the Department of Agriculture of British Columbia (1891), Mr. James R. Anderson, Statistician of the Department, includes a summary of the principal insect pests of British Columbia, and some general remarks upon the amount of damage done by destructive insects, quoted largely from Mr. James Fletcher's evidence before the select standing committee of the House of Commons of the Dominion of Canada, which has already been noticed in these pages. The insects mentioned are all such as are common in our Northwestern States, with the exception of the Vancouver Island Oak-looper, *Ellopia somniaria.*

Recent Entomological Work of the Iowa Station.—Bulletins 16, 17, and 18 of the Iowa Agricultural Experiment Station for February, May, and August, 1892, each contain a single entomological article.

The first of these is by Herbert Osborn and is entitled "Lice affecting domestic animals." It is in the main an extract from the writer's work on this subject, published as Bulletin No. 7 of this Division. It is illustrated by 14 cuts from the same source and covers pages 330 to 353 of Bulletin No. 16.

The entomological portion of Bulletin No. 17 (pp. 444–453) is devoted to the "Effects of spraying on plants and fruit, and notes on insects." In the part of this article on spraying the writer quotes largely from Farmers' Bulletin No. 7 of this Department, and in the second part gives some entomological notes from a correspondent, Miss Alda M. Sharp. An interesting part of Miss Sharp's communication refers to a species of bot in the necks of cats, probably *Dermatobia noxialis.*

The third article (pp. 506–516, Bull. No. 18) is the joint work of Messrs. Herbert Osborn and H. A. Gossard, and is entitled "Reports on injurious insects." The following species are treated: The Clay-colored Bill-bug (*Sphenophorus ochreus*), the Little Brown Bill-bug (*Sphenophorus parvulus*), Strawberry slugs, and the Diamond-back Turnip Moth (*Plutella cruciferarum*). The Strawberry slug which does the principal damage in Iowa is *Monostegia ignota.* Some interesting notes are given on the successful treatment of this insect with London purple, one pound to 200 gallons of water.

The Horn Fly in Florida.—In Bulletin 17 of the Florida Experiment Station, Mr. P. H. Rolfs, the entomologist of the station, gives a summary of the life history of the Horn Fly (*Hæmatobia serrata*) and fixes the date of its first appearance in Florida as the spring of 1891 or late in 1890. He reproduces the figures of this insect given in our account of it in INSECT LIFE (vol. II).

FOURTH ANNUAL MEETING OF THE ASSOCIATION OF ECONOMIC ENTOMOLOGISTS

AUGUST 15—MORNING SESSION.

The Association met at 10 a. m. in Room 14, University of Rochester, Rochester, N. Y., August 15, 1892. The following officers and members were present:

President, J. A. Lintner, Albany, N. Y.; First Vice-president, S. A. Forbes, Champaign, Ill.; Secretary, F. M. Webster, Wooster, Ohio; C. J. S. Bethune, Port Hope, Ontario; James Fletcher, Ottawa, Canada; L. O. Howard, Washington, D. C.; D. S. Kellicott, Columbus, Ohio; Herbert Osborn, Ames, Iowa; C. H. Perkins, Burlington, Vt.; C. V. Riley, Washington, D. C.; P. H. Rolfs, Lake City, Fla.; M. V. Slingerland, Ithaca, N. Y.; John B. Smith, New Brunswick, N. J.; E. B. Southwick, New York City; H. E. Weed, Agricultural College, Miss.

In addition to these members, a number of visitors were present at each session. On opening the session President Lintner made the following remarks:

PRESIDENT'S OPENING ADDRESS.

Gentlemen: It gives me pleasure to welcome you to the fourth annual meeting of our Association. Our preceding meetings have been pleasant and profitable to all of our members who have been in attendance, and I trust that this will prove equally so, and that its benefits may go out to many who are not with us, and that it will tend to advance largely the interests of economic entomology—the science to which most of us have consecrated our best energies and our lives, and which, year by year, is demonstrating more clearly its ability to minister to the comfort and well-being of our fellow-men and to the productive wealth of our country.

I am very glad that I can be with you at this time; but, in consideration of the great honor you have done me, in conferring upon me the presidency of this Association, I deeply regret that I have not been able to meet an important requirement of the office. It is made the duty of the president to present an annual address. A serious attack of that atrocious disease, *la grippe*, which confined me to my house for more than three months, followed by a longer period of convalescence, extending up to the present, has prevented the preparation of an address such as I would be willing should follow the very able ones to

which it has been our privilege to listen. That you might not be deprived of your due, I have made request, almost at the last moment, of our First Vice-president that he should, if possible, assume my duty. Notwithstanding his all-engrossing official labors, he has most kindly and considerately consented to relieve me from what would, at this time, have been a burden which I did not dare to bear.

My personal regret that I have been compelled to delegate duty to another is tempered by the assurance that I feel that the Association will have no cause to regret the substitution.

ADDRESS OF FIRST VICE-PRESIDENT.

By S. A. Forbes, *Champaign, Ill.*

Ladies and Gentlemen, Members of the Association: When the doubly unwelcome news came to me from Dr. Lintner that the state of his health would not permit him to prepare the presidential address of the year for this Association, and that he therefore felt obliged to request that I should perform this duty in his place, my time was already fully engaged up to and far beyond the present meeting. I have consequently been able to make only a scanty provision for the emergency, and shall have to claim your indulgence for presenting to you, not a presidential address properly so called, but a brief and hurriedly prepared substitute for one.

For one thing, I have not been able to look the whole field of progress over in our department of scientific work with the careful impartiality which the preparation of such an address requires, and must speak to you chiefly, therefore, of those features of the year's work which have happened to strike my attention most forcibly; and my treatment of the matter will unavoidably have a one-sided character, due to personal interest and personal bias.

I shall make no further apology for mentioning first and foremost the work of the year on the contagious diseases of insects. While these cases of plant parasitism of insects are perhaps not as commonly or as widely prevalent as those of insect parasitism, and while they are more subject, as a rule, to differences of condition, and are consequently less reliable in practice, several of them have this great practical advantage: that the parasitic organisms can be bred and multiplied enormously without the use of the insect body as a medium. The insect enemies of insects have been hitherto reared only on other insects. We know of no artificial food for them by which they may be made ready in advance, as a standing army by whose aid to suppress sudden or overwhelming insurrection. I may say, in passing, that I have hoped that some families of predaceous insects—the Coccinellidæ and a part of the Carabidæ, for example—which feed under certain circumstances upon vegetable food, might be reared as vegetarians, and thus accumulated for use at will as carnivorous enemies of insect

life. The observation made some years ago that most Coccinellidæ feed largely, and sometimes wholly, upon fungi of common occurrence and easy culture, first suggested this idea to me, but I do not know that it has ever been experimentally tested.

Several of the plant parasites of insects, on the other hand, feed greedily on very common substances, and may be kept in stock, consequently, or made to multiply on occasion with enormous rapidity, and so scattered broadcast where and when most needed. This is true of all the bacterial germs of insect disease thus far studied, and also of certain higher fungi infesting insects.

On two of the latter work of importance has been done during the year—on a species chiefly studied abroad, known in the papers of Giard, of France, as *Isaria densa*, and in those of Prillieux and Delacroix as *Botrytis tenella;* and on an American species whose determination, like that of the preceding, the botanists interested have not yet finally settled on, but which now passes among us as *Sporotrichum globuliferum.* Some laboratory work and a good deal of field experimentation with this latter fungus is reported by Chancellor Snow, of Kansas, in his voluminous and important report published in April, 1892. It was also studied briefly by Prof. Roland Thaxter, in 1891, by whom the fact of its ready culture on agar was determined; and it has been the subject of almost continuous observation and experimentation at my own office and in the field since May 11 of last year. This fungus, which springs from minute white "spores," or so-called conidia, penetrates the living insect, and finally imbeds the dead body of its host in a thick felt of white fibers, which become covered with myriads of white or slightly yellowish spores collected in globular heads. It does not form resting spores, belonging, in fact, to an order of fungi in which such spores have never been found, but it may nevertheless be preserved in a living state for many months—certainly over the winter—by simply drying out the ripe conidia. We have so preserved it, in fact, for an entire year, and have found by experiment that the vitality of its conidia is proof against at least ordinary winter temperatures, and against a summer heat of 104° F. It attacks a great variety of insects of all orders, but with various degrees of virulence, according to the kind of insect, the resisting power of the individual, the condition of the weather, and apparently also to some extent according to the previous history of the spores used for infection. That is, it seems likely at present, although not certainly proven, that spores from artificial cultures on nutritive media take effect on insects less promptly and certainly than those derived from growths on insects themselves.

This fungus may be cultivated in large quantity very readily in disinfected fruit jars on corn meal soaked with beef broth, the growth forming a thick layer of dust-like spores on the surface, which may be brushed or scraped off and preserved for use in homeopathic vials, plugged with cotton. I give here this sketch of the present state of

our knowledge of the economics of this because species several of the facts mentioned above have been either ascertained or verified during the year by Chancellor Snow, Prof. Thaxter, or myself.

The so-called *Botrytis tenella* has been extensively advertised in Europe by a firm of Parisian chemists, who send out the spores in plugged test tubes, at 6 francs a tube. I have obtained two of these packages from these dealers—who, by the way, want an American agent—and one directly from Prof. Giard himself. From these tubes cultures have been made by Prof. Thaxter and by Mr. Marten in my laboratory, and experiments have been tried with the product on the white grub, for whose destruction this fungus is especially recommended, and on various other insect larvæ. I may be permitted to add that it has proven with us much less effective, even for the white grub, than our own Sporotrichum.

Perhaps the first international exchange of living insect fungi for economic use was made this year with Prof. Giard, to whom I sent a package of Sporotrichum in exchange for *Botrytis tenella.* I mention this merely to suggest the possibilities evident in this direction.

Another fungus insect disease, the so-called blue fungus disease of the chinch bug, due to a species now called, on Prof. Thaxter's authority, *Empusa aphidis*, has been handled chiefly by Prof. Snow, who used it, with the other diseases of that insect, by the well-known method of contagion, for the wholesale destruction of chinch bugs in the field. It is incapable of artificial culture, but may perhaps be kept in hand alive in relatively small quantity by using hothouse plant-lice as a medium.

Upon the bacterial diseases of insects I do not know that anything definite and conclusive has been done within the year. The discovery reported by me in September, 1891, of the normal and uniform occurrence of several species of bacteria in special appendages of the alimentary canal of certain families of Heteroptera, at all ages of the insect, has involved in doubt a good deal of our earlier work on the bacterial diseases of Hemiptera, and greatly enhanced the difficulty of their investigation. I will mention here in passing, however, the observation recorded in the paper referred to, that cases of apparent disease frequently occur among chinch bugs, in which the mucous membrane of the alimentary appendages in question becomes completely disorganized and broken up, with an accompanying increase in the number of these bacteria. This is a point which we have carefully and repeatedly verified during the present season.

A study of the bacterial diseases of the cotton boll worm is briefly reported, but not fully described, by Mr. Mally in Bulletin No. 26 of the United States Division of Entomology. One of these diseases is there identified with the common white plague of the European cabbage worm and the cabbage Plusia, but economic experiments with this disease seem to have had only negative results.

In Europe, besides the articles of Giard, I have noted in my imperfect reading only an unsuccessful experiment with a parasitic fungus of the migratory locust, reported as *Lachnidium acridiorum.*

I must not leave this subject without more special reference to the remarkably extensive, suggestive, and thoroughly conscientious work of Prof. Snow on the propagation and dissemination of the diseases of the chinch bug, set forth with considerable detail in his report already referred to. Excepting the war on the gypsy moth in Massachusetts, it is the largest practical undertaking of the year in economic entomology.

Certainly this whole interesting and, as I believe, really promising subject has now been so far opened up that neither entomologists nor botanists will be willing to set it aside until it has been thoroughly and critically investigated. It is a very extensive subject when one thinks of the number of fungous species capable of killing insects, of the number of insect species subject to their attack, and of the limited natural distribution of many of the fungous forms, and when one learns—as he will shortly by experience—the numerous and various conditions which will affect both laboratory experiments and field applications. I need not say that the whole matter is involved in difficulties such as make absolutely necessary the strictest methods of experimental science. Without these we should presently find ourselves swamped by a mass of errors or dubious results which could best be disposed of by leaving them on one side as hindrances rather than helps to progress.

We ought also carefully to guard the agricultural public against the disposition of a certain number always to run after any new thing, especially if it has a sensational character. The credit of an unfinished investigation may easily be completely broken down in advance by a too eager appropriation of unverified results. The idea of starting a flame of insect disease in one corner of an infested field to run speedily over the ground, destroying the insect enemies of the crop with no injury to the crop itself, is so attractive to the credulous or to the especially enterprising farmer that he is likely to trust the safety of his crop prematurely to this method to the neglect of other more certain, but more expensive measures; and if a failure follows, whatever the causes or the circumstances, the reaction will be likely to strike too hard and often in the wrong place.

The kindred and really much less difficult subject of the insect parasites of insects has received practical attention in this country, so far as I have seen, only from the agents of the U. S. Department of Agriculture. Mr. Koebele's repeated journeys to Australia in behalf of the orange-grower have attracted general attention. They have resulted in additional importations, more or less successful, to this country of a new Vedalia feeding on Icerya purchasi; of two species of Coccinellidæ (belonging to the genus Orcus), enemies of the red scale and other Coccidæ; of a number of Scymnids; of a Coccinellid devouring Dactylo-

pius; of a lepidopterous enemy of the larger scales, like Lecanium, and of an enemy of the woolly root-louse of the apple, imported from Australia.

To the above list of importations of insect parasites should be added one in which I became personally interested through the kindness of Dr. Riley, more important, if possible, than any of the foregoing because affecting a more destructive insect of a more valuable crop. I refer to a European parasite of the Hessian fly, known hitherto as *Semiotellus nigripes*, of Lindeman, but which should really be known as *Entedon epigonus* of Walker, as I am informed by Prof. Riley, who has compared it with Walker's type in the British Museum. This parasite, received in Hessian-fly puparia coming originally from England, was successfully bred in small, inclosed plat experiments at Champaign, Ill., and the bred adults were released in wheat fields in that State, which were themselves suitably infested by the Hessian fly. Observations and collections made in and about those fields this season have as yet failed to detect the introduced species, but this need not surprise us, especially as the period of its emergence from the parasitized puparia has not yet passed. Scattering widely, as these parasites probably do at best, it may be some years, if the experiment is successful, before their presence is made manifest.

Exportations of American parasites, native or naturalized, have likewise been made to Honolulu, New Zealand, and Australia, to the Cape of Good Hope, and to Alexandria in Egypt. One of special interest to American entomology is a Raphidia, found to destroy the larva and pupa of the codling moth in California, which seems to have been successfully exported by Mr. Koebele to New Zealand.

I need not say to this Association that practical results of the highest economic value have already been reported in this most interesting field and that it will be a crime against the horticultural and agricultural interests of the country to fail to provide in the most liberal way for a work so sound in method and so certainly valuable in result. It is eminently a national work and of far greater than national importance.

And next we turn to a department of investigation which has been commonly claimed hitherto by the economic entomologists, but which really stands for the most part fairly across the boundary line of horticulture and agriculture. I refer to experiments with insecticides. So far as the effect of insecticides immediately on insects themselves is concerned, we may very properly claim this subject for economic entomology; but I am not sure that we do well to abandon our proper work for observations on the effect of the arsenites on the foliage of plants, or for experiments with various kinds of insecticide apparatus, or for any other similar subjects which do not call for the special knowledge or the special methods of the entomologist, but which may very properly be left to the economic botanist or the expert horticultural investigator. This subject of insecticides has been a very inviting one to the

beginner, because it is easily investigated and is immediately fruitful of practical results; and no small amount of excellent work has been done on it during the past year, as for several years preceding. The arsenical poisons have been, as heretofore, by far the most extensively handled in experimental work, as by Washburn, in Oregon, who has brought the expense of sprayings for the codling moth down to 11 cents a tree each; and by Orcutt, in South Dakota, where a horse apparatus for the distribution of poisons in the potato field has been devised and successfully used; and by Woodworth, who reports from California, as the result of a long list of comparative trials, that 1 pound of Paris green to 160 gallons of water served the best purpose for the apple and the pear, and saved two-thirds of the fruit which would otherwise have gone to the codling moth; and by Comstock and Slingerland in New York, where the arsenical poisons were proven to be without effect on wireworms; and in New Jersey, by John B. Smith, who found it practicable to destroy the elm leaf-beetle with London purple; and again by Woodworth, who has done a large amount of valuable work, of a kind which I have already characterized as horticultural, in determining precisely the effect on different kinds of foliage of various percentages of arsenical compounds or mixtures under various conditions of application. Osborn, in Iowa, has found the arsenite of ammonia effective against many kinds of insects and not noticeably injurious to foliage. Fernald uses a pound of Paris green to 160 gallons of water—a level teaspoonful to a pailful—as a safe and effective application for various cranberry insects, and finds as the outcome of a long series of careful comparative experiments that a pound of Paris green to 200 or 300 gallons of water is safe for the apple and destructive to tent caterpillars of all ages. Another useful insecticide is the XO dust, recommended for plant-lice by Miss Murtfeldt, of Missouri, and by Prof. John B. Smith, for the cabbage worm. The extensive insecticide work in Massachusetts done in connection with the remarkable campaign there against the gypsy moth must have received the careful attention of every American economic entomologist.

Kerosene emulsion has been fully studied as to methods of preparation with various kinds of soap, hard and soft, and with milk, by Cook, of Michigan; has been used with success by Fletcher, of Canada, for the cabbage Plutella; by Fernald, of Massachusetts, on the red spider; by Dr. Jabez Fisher, of the same State, for the pear-tree Psylla; by Richman, in Utah, for the cabbage flea-beetle, and by Osborn, in Iowa, for plant-lice of all descriptions. Applied to the asparagus beetle by Smith, in New Jersey, it killed a large part of the larvæ, but not the eggs. A notable idea in the application of kerosene has been worked out by Goff, the experiment station horticulturist in Wisconsin, who has devised a pump and nozzle by which kerosene and water are mixed immediately at the nozzle in any desired proportions, and thrown out as a fine spray without the necessity of previous emulsification.

Concerning pyrethrum, I have seen practically nothing new contributed during the year. Of the insecticides less commonly used, Fletcher has found white hellebore sufficient for the destruction of the cabbage maggot; Washburn has protected radishes against the flea-beetle with a strong tobacco water; Coquillett has experimented further and with good success with lime, salt, and sulphur for the scale insects; both he and Miss Murtfeldt have tried the new thymo-cresol, with especially encouraging results thus far, for scale insects and plant-lice only; and Garman has found the Bordeaux mixture to have insecticide properties hitherto unsuspected. Of other miscellaneous insecticide experiments I can recall only those of Osborn, some showing the precise value of the kerosene pan for the grass insects, and others, still more important, by which as many as 376,000 grass insects per acre (mostly leaf-hoppers and young grasshoppers) were taken by simply dragging over the grass a sheet of iron coated with coal tar on the upper surface.

Concerning that great department of economic work in entomology, which consists of the invention and trial of variations of agricultural and horticultural practice with a view to the control of insect injuries, I regret to say that I have little to report. The most important experiments published during the year are those carried on by Comstock, of New York, in the course of his studies on the wireworms. The often recommended and almost standard remedy, a clean fallow, for these insects was absolutely without effect. Just as many wireworms remained alive after a year in his breeding cage where no vegetation had been allowed to grow, as in his check cage, where grass had been kept growing continuously. Similar failures resulted from sowings of buckwheat, mustard, and rape, and the application of fertilizers of various sorts. In fact, nothing tried was found to serve for the destruction of the larvæ, the only method of value arrived at taking effect on the pupæ and adults in the earth. This was plowing in the interval between August and the following winter, the plowing to be followed by a thorough pulverization of the soil for the destruction of the earthen cells of the pupæ and adults.

In this connection I may also mention Osborn's observation that the clover-seed caterpillar may be destroyed completely by cutting the clover while this insect is in the larval state; and the fact reported in the *Farmers' Review*, of Chicago, that the Mammoth Clover blooms and ripens between broods of the clover-seed midge, and thus escapes that insect enemy.

I cannot pass this point without remarking on what seems to me a loss of opportunity by experiment station entomologists in their failure to avail themselves more generally of the experimental resources of the stations for a trial of variations in agricultural method—in cropping, in preparation of the soil, in cultivation and management of the crops, and the like—as a means of prevention and remedy applicable to the leading insect enemies of the principal farm crops. The fact that

agricultural entomology has lagged so far behind horticultural is largely due to the lack in the past of just those facilities for experimentation on a large scale and during a term of years which, now that we have them at our disposal, we seem not wholly to appreciate.

To the foregoing very imperfect summary of recent progress in the immediate applications of economic entomology I shall now be able to add only a few references to some of the more important publications of the year, dealing elaborately with single insects especially interesting from our present point of view, or bringing together in a more or less exhaustive and monographic form the facts concerning economic groups. Under the latter head we may place an article by Bruner, of Nebraska, on the corn insects, published in his report as entomologist of the Nebraska Experiment Station; a paper on experiments with the cranberry insects, contributed by Fernald, of Massachusetts; the admirable, original, and highly valuable work of Osborn on the grass insects; the model investigations of Comstock and Slingerland on the wireworms, already mentioned; Webster's paper on insects injurious to wheat, in the Bulletin of the Ohio Experiment Station; the paper by H. E. Weed, of Mississippi, on cabbage insects, published in the Experiment Station Bulletin of that State; a bulletin by Smith on the blackberry insects of New Jersey; Bulletins 25 and 27 of the Division of Entomology, U. S. Department of Agriculture, on the destructive locusts of the West; a notable discussion of the scale-insects of California by Coquillett, in Bulletin 26 of the same series; and my own articles on the white grubs and on the fruit insects of southern Illinois, the latter published in the last volume of the Transactions of our State Horticultural Society.

No single insect has received greater attention recently than the gypsy moth in Massachusetts, and we shall probably have at this meeting an authoritative description of the progress of the remarkable measures taken for its destruction there. We must all hope that the result may be such as to establish a firm precedent for the intervention of the power of the State, guided by expert advice, in emergencies of that description.

Reference should also be made here to Mally's published work on the cotton-boll worm in the South, and to Webster's on the crane flies in clover and in wheat following that crop.

Of a great quantity of notes on the life histories and habits of injurious and beneficial insects, and of a considerable number of descriptions of immature stages of those whose life-history has been hitherto but imperfectly known, I can here say nothing. The entomologists in the newer States have an extraordinary opportunity—which they are not slow to improve—for new work of this kind, and even for the discovery and description of new economic species. Nor can I pause to consider advances in apiculture, nor in the culture of the silk-producing insects. An exhaustive treatment of the topic which naturally falls to me would

require mention also of new descriptive monographs, of analytical synopses, and of various other important helps to the determination of species so necessary to our work.

I have even omitted all notice of one important branch of economic entomology, in which I take, myself, a strong special interest, which calls loudly for continuous and active investigation, and which promises a great body of fresh and valuable results. I allude to the study of our American aquatic insects, especially in their relations to fish culture. Now that it has become a fixed feature of the plan of work of the United States Fish Commission to improve and increase the fish supply of our interior waters generally, aquatic entomology, and especially the breeding, determination, description, and illustration of the aquatic larvæ and pupæ of insects, with studies of their distribution, habits, food, and bionomic relations generally, becomes a matter of first-class economic interest. I need not say that the field is new and scarcely occupied at all, or that, although it clearly belongs to us, it has not even been recognized by ourselves hitherto as coming within our sphere.

From the little that I have been able to lay before you of the really important mass of new matter contributed to knowledge during the year by the economic entomologists of America, you may see—what, indeed, no one of you needs to be told—that we are in the midst of a new era of discovery in this field, a period of activity quite unexampled in the history of this country and of the world. This present time is certain to become classic in the history of American entomology. The establishment of the State universities and of the State experiment stations throughout our country has had an effect on investigation in those departments of knowledge which have most to do with the interests of the people, which may be compared, for that sphere, to the effect of the revival of learning in the middle ages. We, as a body, are but at the beginning of a career which cannot but influence greatly the direction and development of applied biology in this country and throughout the world, and must have at least a reflex and secondary effect on pure biology as well. We have, therefore, not only every reason for hopefulness, but for a substantial assurance of an eminent future for this association. I trust that the present meeting may help us forward notably, and that we may go up to the assembly of the entomologists of the world to be held next year at the Columbian Exposition in Chicago, prepared to represent worthily in our department of activity the country and the institutions which have given us so enviable an opportunity.

On motion of Mr. Southwick, seconded by Mr. Smith, the following were appointed by the President a committee on Vice-president's address: Mr. Southwick, chairman; Mr. Smith, Mr. Kellicott. Mr. M. V. Slingerland, of Ithaca, N. Y., was proposed for active membership,

and Mr. Charles French, Melbourne, Australia, Mr. E. C. Cotes, Calcutta, British India, and Mr. W. M. Schöyen, Christiania, Norway, were proposed for foreign membership.

The following paper was then presented:

HYPODERAS COLUMBÆ—A NOTE.

By D. S. Kellicott, *Columbus, Ohio.*

In April last a student in the laboratory of the Ohio State University called my attention to the peculiar appearance of the thymus of a domestic pigeon which he was dissecting. Examination soon showed that numerous individuals of a mite were the cause of the mottled and granular appearance which attracted attention.

The species seems to be *Hypoderas columbæ*, although the archaic figure published by the describer and copied by Murray must leave some doubt.

The facts of its occurrence are as follows: About a dozen pigeons were examined for the parasite, and all the older ones, about half the number, harbored some examples. Two were found containing multitudes; they were lodged in the substance of the thymus and in such numbers, in the two, as to strikingly change its appearance, as noted above. They were also in great numbers about the precava and its branches. A few were seen in the loose tissue about other vessels of the thorax and in the subcutaneous.

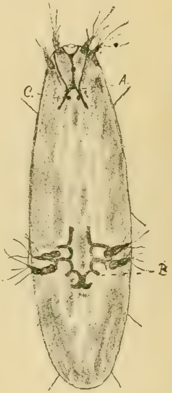


FIG. 7.—*Hypoderas columbæ:* highly magnified; *A*, chitinous framework about anterior legs; *B*, chitinous framework about posterior legs: *C*, chitinous buttons (Kellicott del.).

In the thymus the mites were found somewhat parallel in groups of half a dozen or more; the individuals of the groups were held together by a débris consisting mainly of granules and numerous blood corpuscles. From material preserved some time in alcohol the mites could be dissected out as from a cyst.

The relatively long, slightly depressed animals, by measurement of a large number, gave dimensions as follows: length, 1.5^{mm}; width, .45^{mm}.

The sketch will show in detail the form of body, position, and structure of the appendages. Figure 7 represents the average example seen from below, magnified 56 + times. *A*, the chitinous framework about the anterior pairs of legs; this extends upwards and anteriorly upon the dorsal aspect; *B*, the chitinous framework about the posterior pairs of legs; *C*, three chitinous buttons.

The discussion which followed Mr. Kellicott's paper related very largely to the preparation of these and similar delicate insects for preservation and study. Mr. Forbes strongly recommended cochineal staining fluid for this purpose.

The next paper was read by the Secretary, the author being unable to attend.

THE POSSIBLE AND ACTUAL INFLUENCE OF IRRIGATION ON INSECT INJURY IN NEW MEXICO.

By C. H. TYLER TOWNSEND, *Las Cruces, N. Mex.*

Being situated, as the New Mexico Experiment Station is, in a region where the average rainfall is less than five inches, the question of the influence which irrigation may exert on insect injury becomes with us an important one. The methods of irrigation in practice here are such as to confine the water wholly to the river valleys, over which it is distributed by a system of acequias, it being impossible on the present plan to conduct the water on to the mesas, which are uniformly dry and barren. Therefore, the actual influence which irrigation has on injurious insects in this region does not possess the scope given to the subject in Mr. Howard's able article in INSECT LIFE (vol. II, pp. 215–222), but is confined to the possible effects upon the various pests which infest our orchards, vineyards, ranches, and gardens.

Certain insects, which spend more or less of their life on or in the ground, are readily affected by this means. On the other hand, many which pass most of their existence on trees or high plants, are not so easily reached. The most satisfactory way in which to treat the subject will be to consider separately our various pests, especially those which are not amenable to ordinary treatment, taking up the more injurious ones first.

The Vine Leaf-hopper (*Typhlocyba vitifex*) may be considered our most injurious insect at the present time. If we consider its amenableness to irrigation, we notice that from the egg to the adult it is continually on the upper portions of the plant, except that when newly hatched the young are mostly on the lower leaves, in which the eggs were deposited when these were the only leaves out. It would hardly be possible to raise the water in a vineyard sufficiently to submerge these lower leaves without its breaking out, unless vineyards were surrounded by moderately high levees or embankments. Then it would be a question whether such flooding of the vines would not do more injury than do the hoppers; or whether the young hoppers would not take warning and have time to get on to the higher leaves during the gradual rise of the water. The old hoppers would not be affected seriously unless the water was high enough to nearly cover the vines. It may be thought that turning on the water in the winter would destroy the hibernating hoppers.

Even granting that this would be a practical remedy, the winter irrigation would be likely to cause the death of the vines by inducing growth too early in the season before danger from frost is over. Cleaning the vineyard completely of all rubbish and leaves in the fall would probably be less expensive in the end; and even then the adjoining lands often could be neither cleaned nor irrigated, and would furnish abundant facilities for the hibernation of the insects.

It was attempted last summer to kill the hopper at La Mesa, 16 miles south of here, by turning on the water and then splashing each vine with the view of knocking the insects off into it. It met with poor success and was bad on the vineyard besides, by tramping and disturbing the soil while in a state of mud.

It would seem, therefore, that irrigation would be of little use against this insect. It is not at present directed against it, and probably never will be, since kerosene emulsion is much cheaper and more effective.

The Codling Moth (*Carpocapsa pomonella*) is not yet causing much injury in the vicinity of the station, but is doing so, however, farther north in the Territory. Here is an insect whose life-history is such that it will be considerably affected by an intelligent system of irrigation directed against it. If the water be turned on at the proper season and left for a sufficient length of time, all larvæ in fallen apples will be destroyed. This means would doubtless kill by far the most of the brood, since only a small proportion of the infested apples, as a general rule, remain upon the tree. Used in conjunction with the arsenites, this treatment would be of much value.

The Peach-tree Borer (*Sannina exitiosa*) does not seem to be affected by irrigation (as noted in Bull. 3, New Mex. Station, June, 1891, p. 14), even though the water be allowed to stand for a considerable time and be given thorough access to the roots. It is probable that the borer is protected by the gummy exudation it causes, which, so far as I have been able to determine, covers the entrance to its tunnel and excludes the water.

The Green June-beetle (*Allorhina mutabilis*) would not be amenable to this treatment (as pointed out in Bull. 5, New Mex. Stn., March, 1892, p. 11), or would be but very little affected by it in all probability. The grubs often go to a considerable depth and would be practically below reach of the effects of irrigation. Besides there are large as well as small areas of ground in which the insects doubtless breed, situated in proximity to cultivated portions which could not well be irrigated. In fact such wholesale irrigation as would be required to destroy this and other insects would consume, at certain seasons of the year, many times the amount of the water which flows down the nearly dry bed of the Rio Grande.

There is one point which should be mentioned. If found feasible to irrigate extensively at the usual date of issuance of these beetles from

the ground, concerted irrigation continued for a proper length of time might have a marked effect on this as well as other insects and yet not be found of special disadvantage to crops or fruit.

No doubt irrigation would have little effect on the San José or other scale insects. They can be controlled by other and more effectual means, to which, as an accompaniment, irrigation would prove of no value.

Root-borers of Apple, Quince, or Vine (grubs of *Prionus californicus* and other species) would not be affected particularly in their tunnels in the live wood of the roots, as they are at some distance below ground. Besides it has recently been found that many fruit trees have been killed here by over or improper irrigation, or irrigation at the wrong time of day. Such soaking of the ground as would be necessary to reach these borers would greatly injure the trees. The adult beetles could not be reached by this means.

The flea-beetle (*Haltica foliacea*), which is often very injurious to young apple grafts, might, from its very habit of attacking only the smallest trees whose leaves are near the ground, be controlled largely by proper irrigation.

The Fall Web-worm, which is very abundant on our cottonwoods, could also be controlled on such trees as are situated on irrigable ground; since the turning on of the water would kill great numbers of the larvæ which, so far as my observation goes here, largely seek the ground for transforming.

Such irrigation would also kill the Cottonwood Leaf-miner, referred to in INSECT LIFE (vol. IV, pp. 26–27), which I have been unable to breed as yet, but which I find goes into the earth to pupate. For cottonwoods situated along the roads and sides of streets, such treatment would be wholly impracticable, and the only remedy for either insect would, in this case, be the arsenites.

A native harvest-fly (*Cicada ochreoptera*) does much damage here to twigs and young branches of deciduous fruit trees, especially Pear and Plum. It might prove susceptible to irrigation if the latter were applied at the time when the pupæ issue from the ground.

There is a considerable number of alfalfa insects, more or less injurious, such as lepidopterous larvæ, Capsidæ, leaf-hoppers, and dipterous larvæ, some of which would be and doubtless are extensively checked in their depredations on this valuable forage plant by the process of irrigation. The water is not turned on high enough, however, nor continued for a sufficient length of time, to accomplish any effectual destruction of the insects. The Capsidæ are apparently the least affected.

As mentioned in INSECT LIFE (vol. IV, p. 25), irrigation will doubtless have considerable effect on the Southern sugar-cane borer (*Diatræa saccharalis*), many dead pupæ of which were found in the roots of corn on the college farm last year.

As the Boll Worm (*Heliothis armigera*) pupates in the ground, it can also be largely destroyed by the same means.

Such insects as the Bean Ladybird (*Epilachna corrupta*), the Harlequin Cabbage-bug (*Murgantia histrionica*), the Squash Bug (*Anasa tristis*), and the cabbage-worms (larvæ of *Pieris* and *Plusia*), would doubtless be much affected by submersion of the plants for a considerable time.

Finally, as remarked by the author in *Psyche* (vol. VI, p. 106), our system of irrigation from the Rio Grande River must greatly aid in the dispersion through this valley of our native species of Simulium (*S. occidentale*). These gnats are a great plague to mankind in this region through the spring months, and this is one of the few adverse bearings of the question of irrigation, as practiced here at the present time, on injurious insects.

On the whole, we may safely conclude that, as an adjunct to the proper use of the arsenites and kerosene, irrigation can be made to exert a valuable influence upon the problem of insect injury in New Mexico, and elsewhere as well. Many of the insects for which irrigation would prove a sovereign remedy have not yet reached us here, especially in the southern portion of the Territory. Such are the Chinch Bug, Phylloxera, and Rocky Mountain Locust. When these insects arrive the general usefulness of irrigation in controlling insect injury will, as a matter of course, be considerably extended in this region.

Mr. Smith questioned somewhat the effect of irrigation on the eggs of locusts. In the cranberry marshes submerging did not in all cases destroy the vitality of eggs of some species, and he thought this might prove true with other species in New Mexico.

Mr. Lintner thought that not only the effect of water, but of some insecticides as well, on the eggs of insects was a subject about which we needed much better information than we at present possessed.

Mr. Smith said that kerosene emulsion of ordinary strength would not destroy the eggs of the Squash Bug or of the Elm Leaf-beetle, and eggs of museum pests had been unaffected by an application of carbon bisulphide to the boxes of insects where they occurred.

Mr. Forbes thought, as the protoplasm in the egg was the part which we desired to destroy, we should experiment with such substances or insecticides as would be most likely to destroy protoplasm.

Mr. Smith suggested that, after all, the main effect of kerosene emulsion on insects might be through the respiratory system.

The following paper was then read:

NOTES ON ÆGERIIDÆ OF CENTRAL OHIO—II.

By D. S. Kellicott, *Columbus, Ohio.*

The first collection of notes on the Ægeriidæ of central Ohio was published in the current volume of the *Canadian Entomologist.* Since the former notes left my hands additional observations have been made and a few more species collected. Inasmuch as I shall have some-

thing to say of the destructive habits of the larvæ of these species, this seems to be the appropriate place to present these notes.

Melittia ceto West.—Concerning this species, in view of the facts cited I said in the former paper: "It seems in view of the facts at hand that in central Ohio and south it is double-brooded." In the May number of the *Canadian Entomologist* Prof. J. B. Smith has an interesting note throwing light upon this question; his quotation from the manuscript drawings by Abbot clearly prove that in Georgia it has two annual broods. He also cites the facts of his own observation in New Jersey, and expresses his disagreement with my inference for the latitude of central Ohio. He may be right; I am simply waiting to see. I still think there is something in its life-history not yet explained.

Larvæ put into breeding cages in September last gave imagos in May and June. Larvæ were found destroying the squash plants early in July; by the 15th to 20th I transferred the plants to breeding cages with larvæ of different sizes. These shall be carefully watched and the result reported.*

Sciapteron tricincta Harris.—This species was reared by me several years since at Buffalo, N. Y., from enlargements of the branches and stems of *Populus candicans* and *Salix* caused by the larvæ of *Saperda mœsta* and *Saperda concolor*. The present season I have found it at Columbus, with similar habits, in the stems of the willow injured and enlarged by the larva of *S. concolor*. The beetles appeared from the middle of May to the middle of June; the female gnaws deeply through the bark into the wood, generally near a branch, and places an egg at the bottom of each pit; the larva is soon burrowing under the bark and into the wood; there are often several at the same point. The Ægerians appear later, in June and July, and place their eggs in the excrescences caused by the boring young of the beetle. I have not yet found instances in which it was clearly apparent that the young Sciapteron

---

* NOTE. *August 8.*—By August 1 a few larvæ had left the stems and entered the ground; by the 8th, the day of last examination, many had done so; small ones are comparatively few.

Among the smaller ones there was an abundance of that second form described by Prof. Scudder in *Psyche*, vol. IV, p. 303. Some of these were isolated, and after a few days they molted, giving the typical form. This seems to prove that there is but one species.

It may be interesting to note that these larvæ will feed in the stems and roots of *Echinocystis lobata;* also in the fruit of the Muskmelon. I have not watched them to maturity in either.

August 27.—On returning home, August 25, I found that three imagos had emerged in the vivaria from larvæ transferred from the field between July 15 and August 1; my son had noted the dates of appearance as follows: One each on the 20th, 21st, and 23d; since then two more have come out, and seven fresh imagos have been captured in the field. These facts I consider sufficient to prove that in central Ohio there may be a second brood.

had made its own way into uninjured stems. This fine moth is seldom seen on the wing, but is easily obtained by gathering the stems infested by Saperda in May and keeping them moist for a few weeks.

Ægeria corni Hy. Edw.—The trunks of the maples at Columbus are greatly disfigured by the larva of *Ægeria acerni.* The branches also suffer to a large extent by the action of another Ægeriid infesting them. The former pest is confined almost wholly to the trunks of shade trees; the latter occurs in both shade and forest trees, most numerously in the latter or perhaps in isolated trees in the fields.

The branches ranging from mere twigs to those an inch or two in diameter are found much enlarged, often at several different points, into rough barked and gnarled excrescences; these are often nearly globular; more often, however, oblong, and frequently there are openings into the center of the stem. On cutting into the wood it is found to be mined in various directions and decaying; this often causes the branch to die or so weakens it that the winds throw them down. There may be one or more larvæ in a single excrescence.

The mature larvæ are 12 to 15^{mm} long; body slender, white; the skin is transversely folded, especially in the thoracic rings and there is a strong longitudinal substigmatal fold. The head is smooth, pale brown, with the anterior edge of the clypeus, labium, and mandibles black; the thoracic shield smooth, broad, and colorless; feet pale yellow; stigmata small, round, pale yellow; piliferous spots scarcely perceptible; fine, short hairs chestnut.

The larva changes to pupa in a thick, gummy cocoon strengthened exteriorly by bits of wood and placed in cells just under the bark with a thin outer shell remaining to be broken up by the pupa at the final change, the pupa skin remaining protruded.

The pupa measures 10^{mm}, slender, light brown, with the usual transverse denticles on the dorsal abdominal segments and a circle of stouter teeth about the abdominal tip; the clypeus is armed with spine or tooth.

The moths issued this year from May 11 to July 15. It is a pretty species, the sexes differing somewhat in appearance, the female being easily mistaken for that of *acerni*, although smaller.

The male expands 17^{mm}; the color deep black with some metallic scales; the narrow clothed margins of the wings and heavy discal bar deeper than the apical patch which is more bronze brown; fringes concolorous except the anterior third of inner margin, which is yellow. Clypeus with white lateral lines; palpi light orange, except the blackish third joint and outer side of second apically; collar same color as palpi; antennæ black, slightly washed with white on outer edge of apical third. The thorax yellow below, black above, with long golden cilia about the insertion of the wings. Abdomen black above, same below, with more or less of golden scales running up on the sides at edges of rings, and on fourth ring giving a narrow band, in some seen

faintly, in other dorsal rings. Anal tuft ample, black above and laterally at base; below deep reddish orange. Claspers yellow. Legs: coxæ golden; other joints black outwardly, golden inwardly to claws; last pair with middle of tibia and tips of basal joints ringed with golden; the inner side of fore tibiæ are light orange; spurs concolorous with the golden yellow legs.

The female expands 20mm. General color the same as male, but differs in having less black at tips of palpi; in having much more golden beneath the abdomen; in having the same extending over dorsum so that nearly all the rings are faintly edged and the fourth with a broad band, and in having no black in the ample caudal tuft, which is deep reddish orange.

I have compared the moth with Henry Edwards's description of *Ægeria* and conclude it is his *Ægeria corni*, although one cannot be positive without comparing the type. He had before him only one male taken in Purgatory Swamp, Mass., and the description is not all that could be wished. My specimens differ slightly from the description and vary considerably, frequently more than some of Mr. Edwards's species differ from one another. I will point out some differences which it seems to me are easily reconciled. He gives expanse of *corni* 15mm; the smallest of mine (males) is 15mm, the largest 18mm, average 17mm; he says "no bands;" some of mine are scarcely banded after storage in the cabinet a month; he says spurs light orange, in mine they are not—the only real difference between his descriptions and my moths.

Before our next annual meeting I shall try to compare my moths with the type and shall take pleasure in reporting the results.

Is the moth an inquiline? It would seem so; yet after much searching I have found only one beetle borer that would probably serve as a forerunner. This was found in an excrescence of *Acer dasycarpum*. The Ægerian is far more abundant in *Acer saccharinum*.

Ægeria rubristigma, n. sp.—Whilst searching in excrescences on the oak for examples of *Ægeria gallivora*, I came upon the present species which is less common than *gallivora*. It is a perfectly distinct species and apparently undescribed; hence, I propose to describe it under the name given above. One male and one female obtained.

Female: Fore wings purple black with red scales between the veins and the square stigma at end of cell red; borders of hind wings very narrow, costa reddish; fringes ample, black, yellow at basal third of inner margin of hind pair; beneath fore wings yellow to stigma which is deep orange, beyond the borders and veins black with reddish between; hind wings with costa yellow, also anterior third of inner margin. Head all blue-black with milk-white lines before the eyes; collar yellow; palpi with basal joint black, second black except the front margin which is yellow as is the whole of the third joint; the antennæ are wholly black except the under side of the basal ring which is yellow. Thorax—uniform blue-black with color extending upon the base of wings; metathorax golden yellow; beneath, color as above with a light yellow, almost white, spot under the insertion of the wings. Abdomen concolorous with thorax above and below; the second segment has a narrow dorsal band, the

fourth a wide one extending entirely around the body, and the last with a narrow band all golden yellow; tuft at end of abdomen concolorous above and below with a line of yellow hairs laterally. Legs blue-black varied as follows: fore coxæ outwardly, fore tibiæ, all the tarsi, the spurs, and a band at the middle and apex of the hind tibiæ, yellow; the tarsi, however, have some dark scales, sometimes appearing faintly banded.

The male agrees with the foregoing, except that the abdominal bands are less distinct and the yellow in the caudal tuft is wanting.

Expands 17^{mm}.

Obtained from Cynips gall on twigs of *Quercus palustris*, collected by my friend E. E. Bogue at Sugar Grove, Ohio, and by myself at Central College, Ohio. One imago appeared June 10 and one July 15.

The pupa has the usual form, length 12^{mm}, armed, clypeal spine flattened to a cutting edge apically; there is a median ridge on the dorsum of mesothorax, and on either side of it a parallel groove.

The pupa cell is excavated in the pithy substance of the gall and lined with silk.

This moth should be compared sufficiently for separation with other species from Quercus galls. It differs from *hospes* and *gallivora* as follows: Front blue-black, whilst they have front white; legs black, they have legs yellow; palpi black and yellow, they all yellow with mere tip black. *Rubristigma* has red bar, they black. Compared with *Ægeria querci* from galls on Live Oak, it is twice as large. *Querci* has lemon yellow lines on side of thorax, antennæ brown, yellowish beneath, has nearly all the abdominal rings with bands, costa lemon yellow beneath, leg joints whitish, pectus lemon yellow; in all these points *rubristigma* differs decidedly. The differences are also as striking with *nicotianæ*, with which Henry Edwards compared *querci*, a species having a fiery red discal mark.

Mr. Smith stated that adults of the Squash Borer, *Melittia ceto*, from last year's larvæ, were at present flying on Long Island, and that all stages of the insect might just now be obtained in the same field. The moths collect in the evening on the upper side of the leaves, and are there destroyed in great numbers by farmers.

Mr. Kellicott stated that full-fed larvæ of this species began to take to the ground the last days of July in the vicinity of Columbus, Ohio. The second species or stage, mentioned by Mr. Scudder as occurring at Cape Cod, was also present in abundance, and seemed perfectly distinct.*

---

* Under date of August 25 a note was received from Mr. Kellicott, stating that from larvæ entering the ground late in July there had appeared adults during his absence on the following dates: August 20, 22, and 23, all being active *M. ceto*. This seems to settle the question of the number of broods in central Ohio. There must be two.—SECRETARY. See also foot-note on p. 82.—EDS.

Messrs. Forbes, Slingerland, and Smith were of the opinion that none of the Ægerians were attracted by electric lights.

The next paper presented was on—

THE BEAN WEEVIL.

By M. V. Slingerland, *Ithaca, N. Y.*

The Bean Weevil has recently received considerable attention from entomological writers. Its habit of breeding freely in dry beans has been strongly emphasized, and several interesting features of the first larval stage are noted. Its life history has been regarded as similar to that of the Pea Weevil, *Bruchus pisi*, the egg being laid upon the outside of the pod, the young larva hatching therefrom, boring through the pod and entering the seed, the adults appearing later through a circular opening cut in the shell. The Bean Weevil differs, however, in that more than one may develop in a single seed, and that the Pea Weevil does not appear to breed in dry peas.

No one seems to have seen the eggs of the Bean Weevil laid upon the pod, however, and by confining the beetles in cages with growing beans I have found that this is not their normal method of oviposition. The eggs are laid within the cavity of the pod. This is accomplished in the following manner: The beetle first gnaws a narrow slit about 1 mm. in length through the ventral suture of the pod. It then forces its long, curved, semichitinous, telescopic ovipositor through the slit and deposits its eggs in a cluster inside the pod. The beetles oviposited only on the larger green pods. I have not had an opportunity to study the ovipositor of the Pea Weevil, which would prove interesting in this connection.

After emerging from dry beans, the beetles soon copulate and oviposit, and die in a few days; but when placed in a cage on the growing plant they remained alive feeding upon the parenchyma of the leaves for a month or more. Should it be found that they thus feed in the spring awaiting the growth of the pods, remedies for combatting the pest in the field will suggest themselves.

I have reared several broods of the weevils in dry beans and find that, even when the experiment was conducted in the slightly varying temperature of an office, the season noticeably affected their development. For instance, when the eggs were laid in March adults issued in about eighty days, while in July beetles emerged from beans upon which eggs had been laid only forty-eight days before.

I find the duration of the egg stage in dry beans in summer to be about twelve days; of the larval stage twenty-four days; of the pupal stage, eleven days. During the colder months the stages were passed in twenty, forty-two, and eighteen days, respectively.

Experiments with bisulphide of carbon show that it will destroy all stages of the insect, eggs, larvæ of all sizes, pupæ, and adults. Infested beans were also placed in hot water, 145° F., for one minute, but neither larvæ, pupæ, nor beetles were all killed.

In reply to a question, Mr. Slingerland stated that he had not observed the adult weevils feeding in the field while waiting for the development of the beans. Mr. Smith had kept adults in a jar for six months, and at the end of that time had found adults, larvæ, and eggs, the latter glued to the beans. Mr. Lintner called attention to the fact that the larva, before pupating, left the cell in which it had developed and constructed a second, in which it pupated and from which the adult emerged.

The following paper was then read:

DRASTERIA ERECHTEA.

By M. V. Slingerland, *Ithaca, N. Y.*

Drasteria erechtea is one of the most common and widely distributed Noctuid moths met with in grass lands. The larvæ are loopers, and feed mostly at night, upon the leaves of grass and clover. During 1889 over two thousand specimens of Drasteria were taken in six trap lanterns at Ithaca, N. Y. Although not yet recorded as a serious pest, an insect occurring in such large numbers must be a constant drain on the grass crop. During 1891 I therefore bred what I supposed was *erechtea*, describing all the stages. While critically studying this material in connection with the trap-lantern specimens, I accidentally discovered that my bred specimens were structurally distinct from many of the others, thus indicating that two species had been confused under *erechtea.* Since, through the kindness of entomologists, I have exam, ined nearly three hundred specimens from all sections of the country- and I am convinced that the heterogeneous material existing in all large collections under the name *erechtea* is composed of two, about equally common, distinct species. From an exhaustive study of synonymical nomenclature, I believe these species should be called *erechtea* Cramer and *crassiuscula* Haworth, with *ochrea* and *distincta* as varieties of the latter.

I now have a large series of bred specimens of all stages of both species. In the egg and early larval stages there are no noticeable specific differences, but the mature larvæ of *erechtea* are less variable, of a more uniform yellowish green instead of reddish brown color, and they have a broad, very distinct, bright yellow substigmatal stripe. By the following tabular statement the moths may best be distinguished:

Crassiuscula has the front wings above of either a distinct violaceous, brown, or red shade, with the two large dark bands very variable,

often shading into the ground color on the outer edge or coalescing near the inner margin; all the markings, especially the subapical dentate spots, equally distinct in both sexes; right clasper of male with two rather long teeth; ventral portion of the seventh abdominal segment of female broader than long, with caudal margin broadly emarginate.

Erechtea has the front wings above of a dark or light drab gray (in many females with brown or olivaceous) shade, with the two large dark bands always separate, distinct, and well defined toward the inner margin in the male; in the female the markings always much less distinct, the subapical dentate spots never as distinct as in the male or as in the female of *crassiuscula;* right clasper of male with but one long curved tooth; ventral portion of the seventh abdominal segment of the female as long as broad, with the caudal margin broadly rounded.

Crassiuscula is slightly smaller, more variable, and marked alike in both sexes. *Erechtea* is very constant among the males, but variations of brown and olivaceous occur among females from the same brood of larvæ. After a few specimens of each species have been separated, these differences will be very noticeable, but specimens occur which it is almost impossible to separate by markings alone, and the structural characters must then be examined. These sexual structures are a very striking peculiarity of Drasteria. The asymmetry of the male genitalia, so far as I know, has not been before met with among the Heterocera. The differences in the female structures noted are very surprising between two such closely allied species. These sexual structures vary slightly in individuals, but never grade toward each other.

There are three broods of *crassiuscula* annually in New York, moths appearing in May, July, and September. About one-half of the midsummer brood and all of the fall brood hibernated as pupæ in cocoons of grass and clover leaves. The moths emerging in the spring are on an average smaller than the others, but both large and small appear in all the broods.

The life-history of *erechtea* is similar, I think. I now have larvæ of the second brood from moths emerging in July.

Should the species ever become serious pests, I believe the plowing of infested fields would destroy many larvæ and pupæ.

AFTERNOON SESSION.

The Association met, as per adjournment, at 2 p. m.; the minutes of the previous session were read and approved.

On motion of Mr. Smith, seconded by Mr. Forbes, it was decided that at future meetings the minutes of the first day's sessions should be presented and passed upon at the morning session of second day.

Mr. Slingerland was elected to active membership, and Messrs. E. C. Cotes, Charles French, and W. M. Schöyen to foreign membership.

The author not being present, the following paper was read by the Secretary:

ORTHEZIA INSIGNIS AS A GARDEN PEST.

By T. D. A. Cockerell, *Kingston, Jamaica.*

This interesting species was described by Mr. Douglas in the *Entomologist's Monthly Magazine*, January, 1888, p. 169, from specimens found in England on Strobilanthes, and it was afterwards ascertained to attack a variety of exotic plants in the hothouses at Kew and elsewhere. In "Timehri," December, 1889, p. 308, Mr. S. V. McIntire records its occurrence in British Guiana, and in the same journal for December, 1890, p. 304, Mr. R. Ward gives further particulars of its habits in that country.

In Jamaica I have observed it somewhat commonly on roadside weeds, and, although positive information on this head is wanting, it is very probable that it abounds throughout the island at moderate elevations. As a pest it was first brought to my notice by Miss L. A. Long, who found it very injurious to a small species of Coleus, in Kingston, February, 1892. On June 14, Mr. E. Nuttall brought to the museum a large number of specimens on the leaf-stalks of white violets from Halfway Tree, stating that they were very harmful and interfered with the proper development of the flowers.

As remarked by Mr. Ward, it infests herbaceous plants, and there does not seem any probability that it will cause serious injury to any crop; but as a garden and hothouse pest it is evidently liable to become exceedingly troublesome if not checked by prompt and thorough measures. It does not appear from any records accessible to me that the species is found in the United States, although in Insect Life, vol. III, p. 124, there is mention of an undescribed Orthezia or Coleus in New York and California. It is very possibly common in the West Indies, though only known as yet from one island, and if it does not yet occur in the Southern States it may be expected at any time.

Mr. Webster presented some notes on—

SOME FEATURES OF APPARENT JOINT-WORM ATTACK.

By F. M. Webster, *Wooster, Ohio.*

[Secretary's Abstract.]

He stated that the matter was not presented as a final conclusion, as he had not yet reared the depredator, and though in many respects the attack seemed to agree with that of *Isosoma hordei*, as described by Harris and Fitch, yet in many other features it appeared different. In all cases, and he had examined hundreds of wheat straws from northern Ohio, the attack was always above the upper joint. In two cases the upper joint and the one below had been attacked. From many thorough examinations he had found that the stem itself had not been eaten into, the cells being formed in the sheath, but owing to the

pressure of the galls on the tender stem the latter had become distorted and the upper portion with the head, where one was produced, was greatly aborted. He had, from these galls, reared several parasites, and these were at present emerging, some of them being engaged in ovipositing in the dry galls, and he supposed they were parasitizing the now full-grown larvæ of the true gall maker, whatever that might be. From a lot of infested stems he had reared the following: *Eupelmus allynii* French; *Semiotellus chalcidiphagus* Walsh; a Eurytomid; *Merizus isosomatis* Riley, and *Websteria tritici* Ashm. MS. Some of these he had, during previous years, reared from *Isosoma tritici*, but he had been told by Messrs. Howard and Ashmead that it would be necessary to be most positive about the habits of the *Websteria* on account of the widely differing habits of its nearest allies. Therefore he would delay final publication until the whole matter had been cleared up. A large number of dried specimens of the affected straws were shown, illustrating the work of the depredator, in stems from 4 to 20 inches in length.

The following paper was then read by the author:

A NEW ENEMY TO TIMOTHY GRASS.

By L. O. Howard.

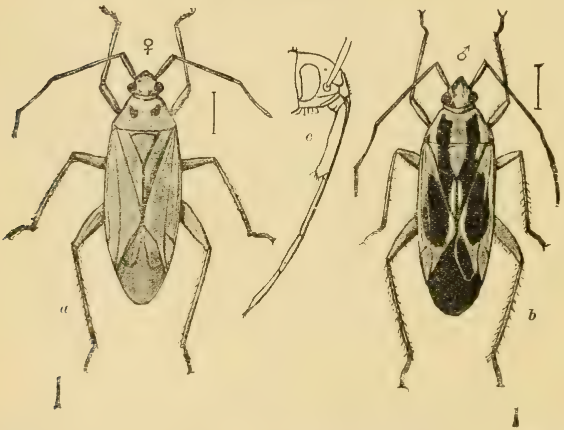


Fig. 8.—*Oncognathus binotatus*: *a*, female; *b*, male—enlarged; *c*, head from side—still more enlarged (original).

There is a handsome plant-bug of the family Capsidæ which was described many years ago by Fabricius as *Capsus binotatus*, but which was placed by Fieber in his new genus Oncognathus in his revision of the genera of this group in 1858, and which is found in different parts of the

world. It is comparatively common all through Europe, and is found also in Abyssinia. It also occurs in different parts of the United States, where it has a general distribution as indicated by Uhler in his catalogue. Mr. O. Heidemann, of Washington, informs me that he has taken it in comparative abundance in Washington during the months of May and June by sweeping the grass, and that he has also met with it in Maryland, and at Berkeley Springs, in West Virginia, late in June. The European distribution of the species, according to Flor, is Sweden, Curland, Russia, between the Ural and the Volga, Germany, Switzerland, France, North Italy, and England. The only European reference to food-plant which I find by a cursory examination is by Kaltenbach, who records it on Chenopodium.

In July of the present year I found this species in a limited locality on Onteora Mountain, Greene County, N. Y., and only at an elevation of 2,500 feet. The flora of the mountain was wild, but at the plateau level mentioned some patches of timothy had sprung up about the cottages, and upon the heads of this grass from July 1 to 15 these plant-bugs were found in extraordinary numbers. Almost every head examined carried from six to fifteen bugs, which were busily engaged in sucking the juice of the plant. I found them in no case puncturing the stem. The heads at this time were in full flower, and while I was called away so early that I was unable to see the full effect of the work of the insects, it seems certain that they must have destroyed all chances of the maturing of the seed.

While possessing the habit common to many Capsidæ of running around the head when approached and hiding on the opposite side, they were loath to take wing, and were readily captured by sweeping or even by the cyanide bottle. All stages of the insect were found, with the exception of the egg. The timothy heads were spotted to a certain extent with black excrement.

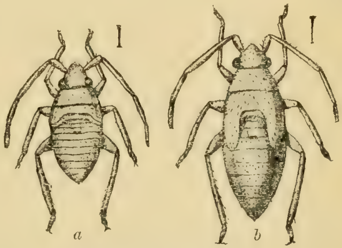


Fig. 9.—*Oncognathus binotatus*: *a*, larva; *b*, nymph—enlarged (original).

Perhaps the most curious part of the observation lies in the fact that 200 feet below this point of the mountain not a bug could be found, while 500 feet below there were very extensive timothy meadows in a condition of rank growth, and I spent upwards of an hour in one of these fields searching for the insect, but without success.

This interesting case of local damage, although occurring to me at first to be dependent upon elevation, must have been due to some other as yet undiscovered local cause, or perhaps it is a beginning of

a new taste on the part of the insect which may ultimately lead to considerable damage to the important timothy crop.

A late letter from Prof. P. R. Uhler informs me that the species was first brought to his notice about twenty years ago, from Canada. Since then, he states, it has spread to Baltimore, where it is occasionally very numerous, locally, along the edges of fields of wheat, oats and timothy, in June.

Mr. Smith stated that he had found the species in New Jersey, at an elevation of only 15 to 20 feet above tide water.

Mr. Osborn said the species occurred in Iowa, but had not been observed on Timothy.

Mr. Webster said that *Leptopterna dolobrata* Linn. had developed in the grass and clover fields, in Ohio, in immense numbers the present year. While many farmers were, for a time, considerably worried over their appearance, no damage had been reported.

The next paper was read by the Secretary.

FOOD-PLANTS OF SOME N. A. MEMBRACIDÆ.

By F. W. GODING, *Rutland, Ill.*

Subfamily **Centrotinæ**.

Insects.	*Food-plants.*
Centrodontus atlas Godg	Leaves and twigs of *Larra mexicana*.
Microcentrus caryæ Fitch	Hickory, Walnut.

Subfamily **Darninæ**.

Stictopelta marmorata Godg	Mesquite (*Prosopis juliflora*).

Subfamily **Smiliinæ**.

Ceresa diceras Say	Low bushes, tall herbage, grass.
Ceresa bubalus Fabr	Apple, Potato, Tomato, Pear, Peach, Plum, Grape, Apricot, Almond, Willow, Locust, Japan Lily, Grass.
Ceresa brevicornis Fh	Hickory.
Stictocephala lutea Walk	Wheat.
Stictocephala inermis Fabr	Plum, Oats, Oak, Alfalfa, grass, weeds.
Acutalis calva Say	*Eupatorium maculatum*, Honey Locust.
Acutalis dorsalis Fh	Grape.
Entilia sinuata Fabr	Potato, Ragweed (Ambrosia), woods.
Publilia modesta Uhler	*Glycyrrhiza lepidota*, Mesquite (*P. juliflora*).
Publilia bicinctura Godg	*Ira xanthiifolia*, *Glycyrrhiza lepidota*.
Publilia concava Say	Canada Thistle, grass, weeds.
Smilia camelus Fabr	Black and Red Oak, weeds along shore of Lake Michigan.
Cyrtosia fenestrata Fh	Oak.
Cyrtosia pallidifrontis Emmons	Oak.
Cyrtosia vau Say	Walnut, Hickory, Oak.
Atymna inornata Say	Chestnut, Linden, Oak, Hickory.
Atymna viridis Emmons	Oats.

Vanduzea arquata Say	Oak.
Vanduzea vestila Godg	Flowers and foliage of Mesquite (*Prosopis juliflora*).
Ophiderma flava Godg	Laurel Oak.
Ophiderma flavicephala Godg	Laurel Oak.
Thelia cratægi Fh	Oak, Apple, Thorn.
Thelia uhleri Stal	Wild Plum, Virginia Creeper.
Thelia univittata Harris	Oak, Grape.
Thelia acuminata Fabr	Locust, Pear, Chestnut, various bushes.
Thelia bimaculata Fabr	Locust, Elder, Black Willow.
Telamona magniloba Godg	Wild Grape.
Telamona fasciata et unicolor Fh	*Ampelopsis quinquefolia*, Grape.
Telamona monticola Fabr. = querci Fh. (?)	Oak, Linden.
Telamona reclivata Fh	Oak, Chestnut.
Telamona irrorata Godg	Oak.
Telamona coryli et tristis Fh	Hazelnut.
Telemona excelsa Fairm (?)	All oaks, except *Quercus macrocarpa*.
Telemona ellæ Godg	Black Willow.
Heliria scalaris Fairm	Beech.
Heliria strombergii Godg	Black Willow.
Carynota mera Say	Butternut, Hickory, Oak.
Carynota marmorata Say	Oak.
Archasia galeata Germ	Eupatorium, *Verbena hastata*, Oak.

Subfamily **Membracinæ**.

Enchenopa binotata Say	Butternut, Birch, Apple, Walnut, Grape, Hop-tree (*Ptelea trifoliata*), Locust, Red-bud, *Celastrus scandens*, Cherry, Viburnum, Ceanothus, White Birch, weeds.
Campylenchia curvata Fabr	Bushes and weeds.

Subfamily **Hoplophorinæ**.

Hoplophora 4-lineata Say	Oak, weeds, bushes.

I am indebted for many of the above facts to Prof. S. A. Forbes, Mr. C. W. Stromberg, Prof. C. P. Gillette, and Prof. C. F. Baker. Other papers on the food-plants of our Membracidæ will be published as rapidly as data are obtained. Local lists will be thankfully received and due credit given.

In the discussion that followed, in which Messrs. Smith, Lintner, Osborn, and Webster participated, strong objections were urged against the use of indefinite terms as weeds, bushes, and shrubs, which might mean any one or more of many species of plants. If the food-plant could not be designated, at least generically, by the original observer it should not be cited at all, in giving the food-habits of insects. The information to be of any value should be more exact.

NOTES OF THE YEAR IN NEW JERSEY.

By John B. Smith, *New Brunswick, N. J.*

The summer of 1892, so far as it has passed, has been, entomologically, a quiet and uneventful one. There has been no disastrous outbreak, no sudden appearance of any new pest, and yet the annual tax levied by insects has scarcely decreased. There has been an increase of injury

from Curculio and Codling Moths, due to the excessive crop of 1891, when in many unsprayed orchards myriads of specimens developed, and the comparative scarcity of fruit in 1892, which is nearly all required by the excessive number of insects craving sustenance. Even in sprayed orchards injury is quite marked, while in some that are unsprayed 95 per cent of the fruit is wormy and the rest is deformed by Curculio punctures. I have counted thirty-five crescents on a single apple no larger than a walnut. The Pear Midge has reached New Brunswick, and has, probably, been there since 1891 at least. Found a few infested pears in a well-kept orchard, and in a neighboring, uncared-for lot of trees, many of them Lawrence, I found a considerable percentage of infested fruit. I have been unable to trace it either south or west of here, and there are some orchards on the direct line between Elizabeth and New Brunswick where it has not been found.

On Cranberry I found, locally, a species of Cacœcia not yet determined and not heretofore recorded on this food-plant. Grasshoppers are complained of as more injurious than ever on the bogs and in some localities have taken to late cabbages.

Cabbages, by the by, and Cauliflower as well, have suffered rather more than usual from the Root Maggot and from the larva of *Pieris rapæ*.

Growers are rather reticent on the subject, but I have reason to believe that a considerable amount of protection from "cabbage worms" is obtained by the use of Paris green.

Early tomatoes have suffered unusually in the southern part of the State from an attack by the larva of *Heliothis armiger*. The early fruit pays so extremely well that truckers are anxious to gain even a day when possible, and every tomato counts. As the earliest fruit was most infested the money injury caused by the insect was quite out of proportion to the actual percentage of fruit destroyed. The larva is locally known as the "heart worm."

Crioceris 12-punctatus has made its appearance near Swedesboro in southern New Jersey. I found it only on volunteer asparagus shoots near the railroad track, and it does not seem to have entered the cultivated beds across the fence.

On May 30, I found one specimen; on June 11, three specimens, and on the 28th, a considerable number of them. July 13 I sought in vain for more, and I have not been in the locality since. How extended its distribution may be in the State I do not know; it has not been complained of as yet, nor has it been taken by the Philadelphia collectors.

Some criticism of my Rose-chafer bulletin was made because I did not personally test the kerosene emulsion, relying upon Col. A. W. Pearson's dixit that it was ineffective. I had tested the pyrethro-kerosene mixture, and finding it ineffectual could not believe that kerosene alone could be more efficient. To make assurance doubly sure, however, I made a series of experiments at Vineland, using the Riley-Hub-

bard formula with a slight accidental excess of soap and diluted the emulsion with eleven parts of water. Sprayed a clump of roses which were full of beetles and spread a canvass on the ground underneath for facility of observation. The spraying was done by means of a Eureka knapsack pump with Vermorel nozzle and was more thorough than would be possible in field practice on grape-vines.

The first experiment was made before 9 a. m., while yet the beetles were somewhat sluggish, and they were well soused. Not a score of them fell to the ground, and of these all but two or three flew off as soon as the sun dried their wings. The defunct specimens were examined and proved worn out females. The experiments were duplicated later in the day on another bush, with the same results. Two separate lots were dipped into the mixture and completely submerged for a moment. These were placed on the ground in the sun, and, as soon as they dried off, at least 75 per cent of them took flight, a few of them only remaining at the end of half an hour. Even were it more effectual the vines could not stand many sprayings of so strong a kerosene mixture. I can therefore confirm, from direct experiment, the statement heretofore based on Col. Pearson's experience.

The insect was less abundant this year in most of the localities previously worst infested, while it did injury in some localities previously nearly exempt. It was much more local than usual, vineyards even in the same mile square being very unequally infested.

There seems to be also a slight change in taste, for apples were preferred to grapes on Col. Pearson's farm, while roses remained prime favorites, even those drenched with the kerosene mixture being eaten readily without apparent injury to the beetles.

At Hammonton strawberries were somewhat injured, but as a whole the insects were less abundant than for several years past and in some cases lime dusted on the plants served as a complete protection, there being an abundance of more palatable food for the smaller number of beetles. Near Lakewood *Anomala lucicola* made its appearance as an enemy to Grape, skeletonizing the leaves. The larva develops in much the same localities as the Macrodactylus, but is smoother and more yellow. When full grown the larval skin splits along the back, but remains entire as a covering to the pupa, which develops within it. I do not remember having seen this feature noted of any larva of this group. The beetle was unusually abundant in some localities in south Jersey, but was not complained of as otherwise injurious.

Some little attention was also devoted to Black and Raspberry insects early in the year. *Agrilus ruficollis* has killed off many carelessly trimmed fields and I have found it in both Blackcap and in Red Raspberry canes, in which it does not do any injury.

The stem-borer which I mentioned in my report of last year as probably Lepidopterous, from a fragment, proves a saw-fly which I have

not yet determined. It is quite generally parasitized and I got only two adults. The common practice of topping the canes destroys most of the larvæ and the insect is thus not likely to become seriously troublesome. I have found it also in Raspberry canes.

Last year I found only a few isolated specimens of the larvæ of *Selandria rubi*, and, hearing nothing of any injury from this slug, did not even mention it in my bulletin. This year the insect developed abnormally in some plantations and destroyed the fruit on many acres of raspberries and on a few acres of blackberries. Even where not positively injurious, it was much more abundant than last year.

I found also, quite commonly, a leaf-roller larva on Blackberry, from which I bred a species of *Phoxopteris* closely allied to *fragariæ* Riley. It did no real damage, but its occurrence is interesting, because I did not see it at all last year.

The sweet-potato crop is an important one in New Jersey, and no better-flavored tubers are raised anywhere. The vines suffer from a variety of insects, and special attention was paid to them during the season. All the Cassids, so well figured in Dr. Riley's Second Missouri Report, are represented in this State, but are single brooded. A little pest that has thus far baffled my efforts to get at its life-history is a flea-beetle, *Chætocnema confinis* Lec. It makes its appearance quite early, as soon as sweet potatoes are set out, and that is anywhere from May 1 to June 1.

It starts generally from the edges of the field adjoining a road fence or a wood, and spreads rapidly over the whole field, eating peculiar and characteristic channels on the upper surface. The leaves dry up and die, and often this kills the plant; I watched the insects from the middle of May to the middle of June, when they had about disappeared, and I failed utterly in finding any trace of their larvæ on sweet-potato vines. I examined a large number of plants from the roots to the tip of the runners, slicing them up completely, and did not see anything that looked like a beetle larva. The inference is that the beetle breeds on some other plant, though I failed to find them anywhere else. In some fields cutworms did considerable injury in their well-known way. I bred none to maturity, but the larvæ seemed to be very like those of *Carneades messoria*, and so Dr. Riley determined them for me.

It is rather curious that all these sweet potato pests attack the vines almost immediately after planting, when they are least able to resist attack. After the vine starts running it is beyond danger of injury.

Insects injurious to the Cucurbitaceæ have formed the main line of study during the season, and of these pests the Squash Borer (*Melittia ceto*) has received the most attention.

I have succeeded in clearing up about all of the moot points in its life-history, and have found what I think is a practical way to prevent serious injury. To ascertain about how many eggs a single female

might lay, and how they compared on the same date, six specimens, taken on July 16, were dissected, with the following result:

No.	Developed.	Undeveloped.	Total.
1....	50	60	110
2....	94	30	124
3....	10	80	90
4....	20	64	84
5....	4	10	14
6...	20	64	84

Four specimens, taken August 6, gave the following result:

No.	Developed.	Undeveloped.	Total.
1....	124	88	212
2....	10	68	78
3....	20	78	98
4....	74	44	118

As developed eggs were counted those that were of full size and of a light-brown color, showing a completely chitinized coat. No. 1 of the lot of August 6 was taken in copulation, and it may be assumed that no eggs had yet been laid. The very large number of developed eggs—124—points to a very rapid oviposition, and this is borne out by observations in the field, the female flitting busily from hill to hill and leaving an egg at every point. What length of time an individual might live has not been ascertained. The insects are rather less common in New Jersey and do not extend over so long a period as they do on Long Island, where Mr. J. V. D. Walker, of Jamaica, introduced me to some very fine squash patches and likewise to a very choice article of mosquito, far superior to anything produced in New Jersey.

I had expected to spend considerable time on the Melon Louse, which for two years had done great injury, and in 1891 had destroyed completely many acres of cantaloupes and cucumbers; but it made its appearance this year only long enough to disappear.

On June 27 I found a few winged viviparous females on melons; some had just come along from somewhere; some were surrounded by a small progeny, and sometimes a small progeny existed without any stem-mother.

The most rigid and careful search in fields on melons for the second year, and which were badly injured in 1891, failed to reveal any specimens on the roots or in the soil, while the plants were not a bit more infested than they were in neighboring fields. On a cucumber patch in another locality I found the Aphids much further advanced, and several colonies of the wingless product of the stem-mother were surrounded by flourishing families of their own. Everything pointed to a favorable season for observation then and next day, when I found the same state of affairs at the opposite side of the State. Between

June 29 and July 5 there was an assorted variety of weather; rain, hail, cyclonic wind storms, and other similar manifestations followed in rapid succession. On July 5, when I again visited the fields, I did not find a single colony of *Aphis cucumeris* on either melon or cucumber, nor have I found more than an isolated specimen here and there since that time. This state of affairs exists all over the truck region of the State, and none of the hundreds of melon and cucumber fields examined showed any trace of injury by the Aphids. So far as my observations go, I am now inclined to believe that the Aphid has an alternate food-plant on which is passed the period between August 1, when it usually disappears from the cucurbs, and June 15, when it reappears on them. This is a belief without much observation to support it, and is put forth as a suggestion merely.

Epilachna borealis, larva and imago, has increased steadily in the last years, and now ranks as an annoying pest, even slightly injurious locally. While it is phytophagic in all active stages, the young larvæ show a somewhat carnivorous tendency. I have noticed on several occasions that the first one or two larvæ from an egg cluster would eat into every unhatched egg in the group before attacking the leaf.

Diabrotica vittata does comparatively little injury with us. It is abundant enough, but is amenable to discipline in the form of plaster, with or without Paris green. Abundant as is the imago on all cucurbs, I have as yet found only a single larva on all the plants I have sliced up. I have seen traces of its work in some instances in the form of channels eaten in the bark of the root; but it certainly is not injurious in this stage in New Jersey. I have pulled up dozens of wilting cantaloupes and many more squash vines and have carefully examined them, yet I have found only a single larva, and in no case was the wilting caused by it. Do the larvæ perhaps have another food-plant? A grower at Esopus, on the Hudson, destroys many of the beetles by sending a man through his patch morning or evening to collect the closed male flowers, in which the insects hide, often in large numbers.

There has been another appearance of the larva of *Phytonomus punctatus*, the Clover-leaf Beetle, threatening serious injury; but it was again checked by the fungous disease that destroyed so large a proportion of the specimens in 1890 and 1891.

The Entomologist has not been overwhelmed with novelties, but he considers that he has work ahead for another season at least, even if nothing new turns up.

Mr. Howard stated that the new asparagus beetle, *Crioceris 12-punctatus*, seems to be spreading very slowly. He also expressed astonishment that the Rose Chafer did not yield to the effect of pyrethro-kerosene emulsion in view of the statement of Prof. Cook in 1891.

Mr. Webster thought it little use to attempt to fight this pest with insecticides, which only killed, and did not protect from continued attack. It seemed to matter little how many were destroyed, as their

places were soon filled by others, and fruit-growers in his State had found it impossible to even partly protect themselves in this manner.

Mr. Lintner thought that the breeding grounds of the pest should be searched for and the larvæ destroyed.

Mr. Smith said he had not found larvæ in damp localities, where they were said to occur, but in dry, sandy grounds.

Mr Osborn felt quite sure that the larvæ of *Diabrotica vittata* must have other food-plants besides the Cucurbitaceæ. He also expressed the opinion that the arsenites might be safely used on Cabbage, in fighting cabbage worms, if the poison was used with proper caution.

Mr. Howard said that about Washington both the native and imported species of Pieris are very destructive to Cabbage, as well as *Plusia brassicæ*, *Plutella cruciferarum*, *Pionea rimosalis*, *Mamestra picta*, and *M. trifolii*, the last-named species being the most difficult to kill. Certain truck farmers, he said, are using arsenical poisons on Cabbage as the only good remedy, but are doing it very secretly.

Mr. Lintner expressed surprise that the Plum Curculio (*Conotrachelus nenuphar*) should be so destructive to the apple crop in New Jersey. No such damage to this crop, by this pest, had been reported in New York.

A specimen of the Asparagus Beetle (*Crioceris asparagi*), taken that day in Rochester, N. Y., was exhibited by a young man, Mr. Ira Wile, not a member of the Association.

Mr. Webster stated that the Clover-leaf Weevil (*Phytonomus punctatus*) had appeared in northeastern Ohio in destructive numbers. He had observed it at Chautauqua Lake, New York, in 1888. The Clover Root-borer (*Hylastes trifolii*) had been sent him from northern Ohio, with the complaint that it burrowed in the roots of peas. Specimens of the depredator and its work had accompanied the complaint. The ground where the attacked peas were growing had not been devoted to clover for several years. *Otiorhynchus ovatus* had shown a fondness for the foliage of the Musk Melon in Wayne County, Ohio, and was very abundant about the vines. No material injury could, however, be traced to their work.

Mr. Lintner said that the last-named species had been reported in New York as infesting dwellings in great numbers, and Mr. Howard said the same had been reported to the Department of Agriculture from Ohio.

Mr. Kellicott offered the following resolution:

Resolved, That we respectfully request the publication, as heretofore, of the Proceedings of the present meeting in INSECT LIFE, and that the Secretary be asked to prepare the same for publication; and that he also be asked to prepare an abstract of the Proceedings and request the publication of the same in the *Canadian Entomologist*.

On motion of Mr. Southwick, seconded by Mr. Smith, the resolution was adopted.

The President appointed as committee on nomination of officers Messrs. Webster, Kellicott, and Southwick.

The Association then adjourned to meet at 10 a. m. August 16.

AUGUST 16—MORNING SESSION.

The Association commenced at 10 a. m., President Lintner in the chair. The minutes of the preceding session were read and approved. On motion of Mr. Osborn the Secretary was instructed to assess the members sufficiently to provide funds for paying the necessary expenses. Carried.

Mr. Kellicott offered the following resolution, which was adopted by the Association:

Resolved, That one member of this Association be appointed a committee (to act with similar committees appointed by other societies) to confer with the council of the A. A. A. S. regarding a change in the day of the week set for the beginning of its annual meetings.

Mr. Kellicott was appointed by the President as a committee to proceed in accordance with this resolution.

The first paper brought before the Association was as follows:

THE PEAR-TREE PSYLLA.

(*Psylla pyricola.*)

By M. V. SLINGERLAND, *Ithaca, N. Y.*

This insect appeared in enormous numbers in different parts of this State, especially in the Hudson River Valley and at Ithaca, during 1891; and orchards which promised 1,200 barrels of fruit at blossoming time developed less than 100 barrels; leaves and blighted fruit dropped in August, and some trees were killed. It is one of the most serious pests that pear-growers have to fear.

The adult insect measures scarcely three millimeters in length, is very active, and strikingly resembles a Cicada in miniature. The nymphs are oval, exceedingly flat objects, of a light yellowish color when young, but becoming blackish with distinct markings when full grown. The light yellowish cylindrical-ovate eggs, which are scarcely visible to the unaided eye, are attached by a short stalk near the larger end, and have a long slender thread projecting from the smaller end.

My observations upon this pest began in December, 1891. At that time adults and a few nymphs were found hidden in the crevices of the bark of the pear trees; no eggs were found. The hibernating adults were watched, and the trees carefully examined at various times during the winter, but no eggs were laid until about April 10, when the adults were frequently seen in copulation. These eggs were laid in the creases of the younger branches, about the bases of terminal buds. Eggs on branches brought into the insectary at this time hatched in

eleven days, but in the field the nymphs did not emerge until about May 10, when the leaves had begun to unfold. The minute creatures immediately crawled as far as possible into the leaf axils and began sucking the sap. This seems to be the favorite point of attack through the season, and nymphs are invariably found in the leaf axils or on the stems of the fruit, unless very numerous, when they cluster about the branches just below the leaves or along the midrib of the leaves. They prefer the younger and tenderer branches and leaves, which often droop early in the season from the excessive loss of sap occasioned.

By careful observations upon isolated individuals, I have found that the nymphs moult five times, including the one at which the adult insect appears.

Adults of the first spring brood began to appear about June 1. For two days after emerging they were of a greenish color and then took on the characteristic red and black markings. Eggs from these adults were plentiful about June 15 and were found on the under side of the younger leaves, usually partially hidden in the pubescence along each side the midrib. Adults of this second brood appeared in about thirty days, or July 15. There will thus be at least three and probably four broods during the season. During the summer all stages of the insect may be found on the trees, owing to the overlapping of the broods.

The summer forms of the adults are smaller and less intense in coloring than the hibernating adults. In the former the front wings are of a yellowish tinge, and the veins, even in dark specimens, are light yellow, while the front wings of the latter are nearly transparent, with dark shades in the cells and very dark brown or black veins. After a careful comparison of both forms with the descriptions of the four known pear Psyllas, *pyri*, *pyricola*, *pyrisuga*, and *simulans*, I am led to believe that the insect in question is *Psylla pyricola*, and that *Pyslla simulans* is the winter variety or hibernating form of *pyricola*.

Last year the nymphs were so numerous by June 15 that the honeydew secreted covered the branches and trunks of the trees, and was accompanied by the usual black fungus, which gave the trees a very smoky, unhealthy appearance. The honeydew appears to be secreted only by the nymphs, but in what manner I do not know. The excrement and honeydew are distinct, the former having a firm, whitish appearance, while the latter is clear, like water. I think both secretions come from the anus.

REMEDIES.

I have fought this pest in all its stages except the adult. It is claimed by those who tried spraying the adults in the summer that they were exceedingly active and arose from the tree in a cloud as soon as the spray struck the leaves; possibly some were killed upon returning to the tree by the adhering spray. The hibernating forms, however, are quite inactive, sometimes coming from their hiding places and crawling

about the branches, and I believe many of them would be destroyed by washing the trees thoroughly with a dilute kerosene emulsion in the winter.

Many entomologists advise the use of kerosene emulsion to destroy the eggs of Aphids and, as the eggs of the pear Psylla were similar, I confidently expected to be able to easily destroy the exposed eggs laid in the spring. In brief, the results of my experiments were, that nymphs emerged from eggs which had been dipped in the following substances: Kerosene emulsion diluted to 33 per cent kerosene, or diluted to 17 per cent, and heated to 130° F.; pure kerosene, benzine, turpentine, pure, and as an emulsion; resin wash, triple strength; whale-oil soap, and sulphide of potash wash, and carbolic acid and concentrated potash when diluted so as not to injure the buds, did not kill the eggs. It is thus seen to be impracticable to try to fight the pest in the egg state. I notice in the last June number of INSECT LIFE a communication which records similar unsuccessful results in trying to destroy the eggs of Aphids. In the reply the writer still adheres to the belief that they may be killed by kerosene emulsion, but I have been unable to find any account of previous careful experiments in this line. I believe that there is too much theory and too little scientific practice put into our recommendations for destroying not only the eggs of Aphids, but other stages of other insects as well.

Failing to check the pest in its egg state, I began experiments upon the nymphs and very soon found that they were very susceptible to kerosene emulsion even when diluted to 2 per cent kerosene. As they congregate in the leaf axils, the emulsion would the more easily run down the leaf petiole and destroy them almost as soon as they were touched by it. Field experiments showed that fully 90 per cent of the nymphs of all sizes could thus be reached and killed by one spraying. This is, therefore, the stage in which to fight the pest.

Some claimed that last year there was so much honeydew that the nymphs were completely enveloped in it, thus protecting them from the insecticide. I have sometimes seen a few nymphs thus covered, but I noticed that the rains washed off the secretion to a large extent. I therefore believe that a very practicable method of combating this serious pest is to spray the trees with kerosene emulsion diluted to 2 per cent kerosene in the spring soon after the leaves have unfolded; the proper time in this State this year was about May 15. The best time would be after a rain when the trees have become dry again. There would then be less honeydew to protect the nymphs. A rain soon after spraying does not lessen the destructive effect of the emulsion, which kills almost instantly. A second spraying a few days later would be advisable. Of course other broods of the nymphs may be destroyed later, but it is important that the early brood be checked, for the greater part of the damage is done before June 15.

The pest has not appeared in such alarming numbers this year as one

would expect from its great abundance last year, due, I think, to some extent to the fact that the trees were coated with a sheet of ice for nearly a week at one time during the winter when many of the hibernating adults must have perished. This year the trees are infested, but not to an alarming extent, and they are making a good growth; but, owing to the great drain of last year, but few trees blossomed, and those which did had not sufficient strength to develop the fruit.

Mr. Osborn asked if the insect was not easily killed on the wing. Mr. Slingerland stated in reply that he had understood that the adults took wing as soon as any attempt was made to spray the trees upon which they were located. In reply to a question of the southern limit of the species in New York he stated that he had no information of its occurrence farther south than Catskill Landing, on the Hudson River.

Mr. Riley believed the author was correct in his identification of the species, and in the conclusion that *simulans* was but a form of *pyricola*. He also fully agreed with the statement made by the author in regard to the effect of kerosene emulsion on the eggs of insects; that the published statements as to its effect upon insect eggs were in many cases hypothetical, and not based on actual experience, was but too manifest. His own experiments have been largely confined to the eggs of Aphididæ which vary considerably in thickness of shell, but so far as his observations went they would indicate that a strong kerosene emulsion, while not causing the eggs to shrivel at first, would in the end destroy—*i. e.*, prevent the hatching—of large numbers, especially where the treatment was repeated. Experiments on the eggs of Aleyrodes on the Orange gave similar results. He would call attention to two facts which would, to some extent, explain the varying experience in this particular line; first, the difference in resisting power and thickness of egg-covering; secondly, the character of the emulsion and the method of its application. A stable emulsion, made according to the Hubbard formula and applied in a very fine spray, would be much more effective than an unstable emulsion applied in a coarser spray. The value of the emulsion depended largely on the extent of the divisibility of the oil globules in the menstruum or emulsifying agent; where these particles were relatively large no amount of spraying would cause any of the oil to adhere to a highly polished surface like that of most insect eggs, whereas when the particles were microscopically minute and the spraying very fine, the particles would be more apt to settle upon such a surface.

Mr. Lintner stated that in spraying for the Psylla, only the Cyclone nozzle should be used, as it discharged the liquid in such a manner as not to agitate the foliage, and thus disturb the insects, who were thus drenched without warning.

Mr. Smith said that he had been very successful with kerosene emulsion in destroying the eggs of *Pulvinaria innumerabilis*, and in

New Jersey growers at Vineland destroy the grape-vine leaf-hoppers, by tarring both sides of a stiff card-board about 15 by 20 inches nailed to a wooden handle of some kind. The grower walks between the rows, stirring the vines so as to induce the specimens to fly, and waving the tarred boards forward and backward most of the specimens are captured. More are captured on the back of the board than are taken on the front of it. Two or three journeys through the vineyard are usually sufficient to clear it of insects.

Mr. Riley stated that there could be no doubt as to the dual nature of honeydew, or rather of its treble nature, as he had long been satisfied of the facts from his own observation. The liquid thrown off by the honey tubes is frequently ejected to a considerable distance and showered in the form of a fine dew upon the foliage beneath, and this is the explanation of the very general glossiness of the leaves of trees affected by certain species of Aphides, especially in early summer. That the excrement is also liquid and saccharine may be easily proved by observation not only in this family, but in the Coccidæ, while there is a third kind of honey dew which has no connection with insect secretion, but is an extravasation of the sap of plants caused particularly by great extremes of temperature during rapid growth.

THE PEAR-LEAF BLISTER MITE.

(*Phytoptus pyri.*)

By M. V. Slingerland, *Ithaca, N. Y.*

This pest is alarmingly on the increase in the United States and Canada, and threatens very serious injury to our pear interests unless speedily checked. The mite was discussed at some length in Bulletin 23 of the Cornell Experiment Station. Since then I have made a few additional observations and have discovered what I believe will prove a practicable method of exterminating the pest.

The life-history of the mite appears to be, in brief, as follows: The mites which are hardly visible to the unaided eye appear on the leaves as they are unfolding in the spring and form small bright red spots or blisters, having small openings on the lower side of the leaf; the eggs are laid within the galls and the young escape through the opening and form new galls. As the season advances the galls change color, and about June 1 they are green, distinguishable from the remainder of the leaf only by their slightly raised corky appearance. In about a week they assume the characteristic black or brown color which they retain until the leaves fall in autumn. When very numerous, the galls coalesce and often cover nearly the whole leaf. In the autumn, before the leaves fall, the mites leave the galls and enter the winter buds. Usually they are to be found beneath the two or three outer scales of

the terminal buds where they remain until the leaves unfold in the spring.

It is thus seen that the pest is well protected at all seasons from any poisonous application which might be made. We found that kerosene emulsion would not reach them while in the galls, and it was thought recourse must be had to mechanical means, such as removing and burning the infested leaves which might be practicable on a few choice trees, or by carefully pruning and burning the young wood in the winter, thus destroying the hibernating mites. Both these methods would be laborious and impracticable on a large scale.

While experimenting to learn the effect of pure kerosene on dormant wood, I noticed the thoroughness with which the oil penetrated every crevice of the wood, and at once suspected that it might be used with effectiveness against the Pear Mite while in its winter quarters. Last fall I therefore marked several small trees which were very badly infested, and in February two trees were treated with pure kerosene; on another tree kerosene emulsion (Riley-Hubbard formula) diluted with $2\frac{1}{3}$ parts of water was applied with a brush. One tree was left untreated as a check. This spring the mites appeared in force on the check tree, but upon the trees treated with the kerosene emulsion not more than a dozen galls have been formed, the pest thus being nearly exterminated. The trees treated with pure kerosene were very seriously injured, but the only effect upon the tree treated with the emulsion was a slight retardation in the unfolding of the leaves in the spring.

This single experiment on so small a scale is of course only an indicator, but could anyone have seen the check tree and the one treated with the emulsion last season and this, I think he would agree that the result strongly fortifies the statement that in kerosene emulsion containing at most 20 per cent of kerosene we have a very practicable remedy for this pest when in its winter quarters.

The coming winter more extensive experiments will be made and next spring I hope to report equal success with even a less percentage of kerosene applied with a common sprayer.

Mr. Lintner reported the insect as excessively abundant in eastern New York, and Mr. Webster reported it very abundant in Ohio, and stated that spraying with Bordeaux mixture had not shown any beneficial effect.

Mr. Smith stated that in New Jersey the *Phytoptus pyri* has been more than usually abundant. It is, however, very much less troublesome in sprayed orchards than in those unsprayed. The station recommends for orchard practice a spraying before the flower buds open, using carbonate of copper dissolved in ammonia as the fungicide, and London purple as the insecticide. Two sprayings with the same mixture are made after the fruit has set, and after that the fungicide, alone is used. In orchards so treated no injury was done, while in untreated

orchards a large proportion of leaves were lost. In the sprayed orchards plant-lice were also very much less troublesome than in those unsprayed.

The following paper was then read:

THE PARSNIP WEB-WORM.

(*Depressaria heracliana* DeG.)

By E. B. Southwick, *New York City.*

In the year 1887 I first began to make observations on this insect, but had for many years before noticed it working upon the wild parsnip in the field and along the fences and ditches.

On the farm where I spent my vacations in the summer, at New Baltimore, N. Y., the wild parsnip grew in the greatest perfection, and here the Web-worm was found, but on an island in the Hudson River opposite this farm I never saw one of these insects, although there were acres of wild parsnip, even more luxuriant in growth than upon the upland.

In meadows that were annually producing hay and along the ditches and fences of the farm they were very abundant and afforded a fine field for the collector of Hymenoptera and Diptera, and while collecting and studying these forms of insect life, my attention was directed to this very destructive insect working upon the umbels and other parts of the plant. In this case, however, they were doing no especial damage, for the wild parsnips were considered a curse among the farmers. Had these parsnips, however, been cultivated for their seed, the damage would have been very great, and a different aspect would have been given to the case, and a cry of alarm raised.

In that year I made many notes as to their habits and manner of working, but it was not until the next year that I bred them and obtained the imago.

In 1889 I again bred numbers of them, but not until 1890 did I succeed in obtaining parasites from them. I then collected a barrel of the stalks and brought them to New York City, as I had before done, and placed them in my glass breeding cages. From this lot I obtained many moths and three species of a Hymenopterous parasite and one Dipterous.

The Hymenoptera, Mr. Ashmead said, were species of *Limneria*, but he could not at that time quite determine what particular species they were. This breeding of parasites was quite interesting to me, for Dr. Riley, in Insect Life, had said that no parasites, as far as he knew, had ever been bred in this country, and Dr. Bethune also stated that he knew of none, and both Dr. Riley and Dr. Bethune had given this insect some attention. Other parasites have, however, been bred from it in other countries, for which see the article in Insect Life, some of these

parasites being found in the roots of the parsnip, together with the pupa cases of the moth. I have never examined the roots of the plant to see if the larvæ did go down into them, but I presume they do so when very abundant and can not find sufficient accommodation in the stalk itself, which is often very full of the silken cocoons of the pupæ. Many of the larvæ had eaten through the nodes, and even the internodes of the stalk were perforated. The habits of entering the stalk at the node seemed to be preferred, however, after the leaves and sheaths had been devoured and under the frass collected at that point.

The stalks of the parsnip in this field were so completely stripped of every umbel and leaf that they presented nothing more than a mass of dry sticks standing among the grass, and in this case materially lessening the seed crop, and therefore the plants for the coming year.

Sometimes as many as five of the pupæ would be alongside of each other, but each in its own silken cell.

The larvæ taken by me in 1887 were found in the first week of July, the most of them at that time having entered the stem to pupate. In 1888 it was the last week in June, and then all were in active operation under cover of their webs.

No doubt birds do feed upon these larvæ, and Bethune says the Hairy Woodpecker (*Picus villosus*) visited the parsnip stalks in his garden daily and pecked away at the larvæ and pupæ within. Although birds abounded in the meadows and adjacent woodland, yet after several years observation I have never seen a bird obtaining its food from this source, although nothing could be easier to obtain, or more delicious when obtained, than the larvæ of this insect. I have examined hundreds of webs, and while I have found many empty of larvæ, I have attributed their absence to be charged more against the Potter Wasp than to the work of birds, who either do not know a good thing when they see it or fail to see it altogether.

I discovered that one of the worst enemies the Web-worm had was the Potter Wasp (*Eumenes fraterna*), a veritable canine in propensities for hunting and capturing the caterpillar.

One of these wasps would alight on the umbel in which a web was situated and would begin to peer into it first at one end, then at the other, all the time getting more and more excited. On discovering the worm within it would commence to run its abdomen into the end of the web, with its head directed towards the opposite end, trying in this way to eject the occupant, and every now and then darting at the orifice as the worm would approach it. In this way it would work for a long time, first at one end and then at the other, no doubt each time thrusting out its sting. In this way it continued, packing the silken cell at each end until it became too short to longer cover the larva and keep out of reach of sting and jaws and it was forced to show itself, when the mandibles of the wasp sank deep into it and it was dragged forth from its burrow. Sometimes this was done with great difficulty, but

by repeated stings and jerks it would finally be dislodged, when the wasp would again sting it and then fly away with it to its cell as food for its young.

A few days before I had found on an old golden-rod stalk in an open woods four cells of the Potter Wasp, and all were filled with larvæ, many of which were the larvæ of the Parsnip Web-worm, and all of them nearly the same size, the size, no doubt, easiest to dislodge, or at least easiest to carry.

Last summer, 1891, I discovered another means at work reducing the larvæ of the Web-worm. Along a great ditch that ran through the farm the parsnips were very abundant, and on them I found that some disease, apparently, had destroyed many of the larvæ, they being dead in their webs and of a black color and in every case very soft and flabby. This I attributed to a fungus attack, for in this strip about five-eighths of the larvæ were dead. I collected a large number of them, but could find no marks of the sting of a wasp upon them, for I thought perhaps this might have something to do with their destruction. While the tendency of the poison of the wasp is to preserve them alive, although paralyzed for a while, I therefore tried to find some that were in this condition, perhaps recently stung, but could find none but what were black and flabby; and this, with the fact that I could find none of the dead ones on any other part of the farm, led me to believe that the destruction was due to some bacterial (?) germ, perhaps.

Dr. Riley quotes Stainton as saying that the eggs of the Web-worm are deposited in the spring by the hibernated female moth upon the undeveloped umbels of the Parsnip, and Dr. Riley adds that it is not at present known whether there are two broods, though this is quite probable.

It seems to me it would be poor economy to force, at such an early date, these moths into hibernation, for the dangers from their natural enemies would be so great at that season, as to almost, if not quite, exterminate them. With this end in view I have diligently searched for a second brood, and thought they would be found on the Wild Carrot later in the season, but all my searching has failed to reveal a single larva of this moth on the Wild Carrot, although this plant was everywhere abundant, to a degree detrimental to the growth of grass and other crops.

I placed a lot of the moths in a roomy cage with plants of the Wild Carrot, but they seemed to care for nothing, but were continually crawling under anything that would cover them, or they would remain quiescent at all times. No eggs, as far as I could discover, were ever deposited, although they lived for some time, and the carrots with roots also gave them ample temptation, as they were growing, to do so. I darkened the cage, but that did not seem to make them any more active. When disturbed they would dart about with great rapidity and force. I kept some of them until the 29th day of August, and, although the

conditions for hibernation, and even food, if they desired it, in the form of honey, was given them, they all died.

I was at the farm the second week in August last year, 1891, and found many of the moths about the house and outbuildings. In the carriage house, where I had a work table, I could see them running behind the joists and even over my table and under the boxes thereon, their flat bodies enabling them to crawl into very narrow places. This habit of crawling behind and under cover looks as if they were seeking a place to hibernate. They could be seen behind the blinds on the house, and when these were opened or closed would immediately disappear behind them again.

In December of the same year I again visited the farm, and, determining to see if any of the moths could be found, I searched around the buildings, and behind an old-fashioned lantern I found one of the moths as lively as could be, although the weather was very cold; and further search revealed many of them hidden away behind pieces of boards and old shingles that had been stuck in behind the studding. New Year's night, on retiring to our room, Mrs. Southwick discovered one of the moths on the lace curtain, and together we found several of them under the lambrequin over the window, commencing the new year apparently with as much vigor as they had when they emerged from the parsnip stalk. This does not prove they are but one brooded, or that there is only one brood during the year, but it seems to prove that they do hibernate and perhaps may be the same moths I so often saw on the window blinds in August. Yet, I do think it is poor economy to commence to hibernate thus early in the season. Perhaps the moths do go out nights and eke out a precarious living from the flowers until autumn; but I have collected with lights, and sugared a great deal here, yet have failed to take a single one or see a moth resembling it.

Discussion of Mr. Southwick's paper was deferred, in order to admit of the presentation of a paper on—

AN EXPERIMENT AGAINST MOSQUITOES.

By L. O. Howard.

[This paper has been already published in Insect Life, vol. v., pp. 12–14.]

As Secretary of the Society for Promotion of Agricultural Science, Mr. Howard extended an invitation to the Association to meet with his Society at 2.30 p. m., to listen to entomological papers by Messrs. Herbert Osborn and H. E. Weed.

On motion the invitation was accepted.

In discussing Mr. Howard's paper Mr. Riley stated that he was glad to note the practical suggestions thrown out by Mr. Howard, in regard to preventing the development of the Mosquito.

The idea of doing anything at all practical on an extensive scale by the rearing of dragon-flies had always seemed to him somewhat visionary, whereas the use of kerosene in special cases promised satisfactory results. Mr. Howard's careful experiments were the first, he believed, to show how very effective under certain circumstances kerosene was.

In discussing Mr. Southwick's paper Mr. Forbes thought that much might be accomplished by artificial diffusion of the disease mentioned as attacking the Depressaria larvæ, by Mr. Southwick.

Mr. Lintner had been troubled by a similar disease, working among the larvæ of several Lepidoptera in his breeding cages.

The following notes were then presented:

NOTES FROM THE MISSISSIPPI STATION.

By Howard Evarts Weed, *Agricultural College, Miss.*

The following short notes embrace only notices of some of the more common insects which have been especially injurious during the past season.

In October of last year the Horn Fly was quite abundant in some of the eastern portions of the State, but by many was not supposed to be a new pest. One point in regard to this insect has been especially noticed this season, which I do not find mentioned by those who have given the subject especial attention. This is in regard to what cattle are especially attacked. Riley and Howard in Insect Life (vol. II, p. 100) say: "Certain cattle again will be covered with flies and will lose condition rapidly, while others are but slightly troubled," but so far as I know no writers have mentioned just what cattle are most attacked. I have found that the dark-colored cattle are most attacked, as, *e. g.*, a black cow will be covered with the flies while a white cow, standing alongside, will be almost if not entirely free. The experiments of Riley, Howard, Smith, and others in regard to the application of various substances to the cattle as preventives have been repeated with nearly the same results. So far as I know we have no substances which will keep the flies from the cattle long enough to be of practical benefit. Early in July the kerosene emulsion remedy was given a thorough test. The milk emulsion was used diluted to one-twelfth. The spray was applied by means of a knapsack pump at milking time in the morning for three days, when the flies had so disappeared that they were not again numerous for three weeks.

Chinch Bugs were reported in small numbers early in May, but none were to be found by the middle of June.

Cerotoma caminea is very injurious to beans throughout Mississippi. The dark yellow eggs of this insect are laid around the stem just below the surface, from six to ten in a cluster. The larvæ eat around and within the stem. There are two broods a season, the beetles being

most common in April and July. The broods overlap, however, so that the beetles are to be found at most any season. The first brood is produced upon garden beans and the second upon cow peas. The mature insects eat holes in the leaves, which habit is especially noticed with the first brood upon beans.

Mecyna reversalis has been very injurious this season to various species of Lupines growing in the grass experiment beds.

Arctia phyllira has this season proved a new and seriouspest to Cotton in a limited area about eight miles from the Experiment Station. About the middle of June several acres of cotton were entirely stripped by this insect. Should this species increase to any extent it may some time prove a more serious pest to the cotton crop than either the Leaf Worm or the Boll Worm.

Mr. Bethune stated that the Horn Fly had this month been noticed for the first time in the Province of Ontario, at Oshawa, Toronto, and London, and was creating some alarm among stock-owners.

Mr. Webster stated that last fall, at Columbus, Ohio, he had found that 20 per cent of the flies taken from cattle were infested by a very small mite belonging to the family Gamasidæ.

Mr. Smith said that the Horn Fly was now not more abundant in New Jersey than the ordinary Cattle Fly (*Stomoxys calcitrans*).

Mr. Kellicott stated that his son had recently written him of the abundance of the Horn Fly in central Michigan.

Mr. Weed stated that dark-colored cattle were worse attacked than those of other colors. Mr. Smith said the Jerseys suffered most, while Mr. Webster said at Columbus, Ohio, last year, the red shorthorns were the worst afflicted. Mr. Weed reported the pest in Louisiana and Mr. Webster from western Indiana, it having first appeared in that State in the summer of 1891, about Richmond.

Mr. P. H. Rolfs, of the Florida station, stated that this insect made its appearance in his State about a year ago and had now spread nearly to the central part of the peninsula of Florida, moving southward, and in the opposite direction from which cattle were being shipped. They appear in April, and therefore their season of breeding is much more protracted than farther north.

The following paper was then read:

NOTES ON INJURIOUS INSECTS OF 1892.

By HERBERT OSBORN, *Ames, Iowa.*

Up to the present time no prominent outbreak of insects has occurred in Iowa, nor, so far as I know, in the western portion of the Mississippi valley. Plant-lice have been noticeably few in number, especially as compared with last year. Their ranks were much depleted by para-

sites in the latter part of last season and the effect of this depletion is still evident. Quite likely also the climatic conditions of the present season helped to prevent their increase.

The "bill bugs" have for the first time caused serious injuries in the State, *Sphenophorus parvulus* being the species that seems most widespread and destructive. *Sphenophorus ochreus* is often seen, but has not been reported in the same destructive numbers as *parvulus*. It is not likely to cause extensive damage in Iowa, as there are not such large areas of swampy land, producing rushes, as in some neighboring States, the draining and cultivation of which results in such increase of their damage. There is, I believe, so far no evidence of their attacks upon valuable crops except in the imago stage. *Sphenophorus parvulus* seems, however, to have increased rapidly in late years and threatens to become a very serious pest.

An outbreak of the Army Worm (*Leucania unipuncta*) in Muscatine County has been reported to me with the statement that much damage was being done, but I have not as yet learned how extensive an area is affected.

The common species of locusts (Acridiidæ) have been quite abundant, and though not causing particularly noticeable losses have drawn extensively upon crops. They attacked particularly grass and clover.

Several species of Lachnosterna were plentiful during the spring, those in greatest numbers being *L. fusca*, *implicita*, and *gibbosa;* others in less abundance were *grandis*, *dubia*, and *arcuata*.

Plutella cruciferarum has been unusually plentiful on Cruciferous plants and especially destructive on some experimental patches of Rape on the College Farm.

The Colorado Potato-beetle has not been seen and its absence is so marked as to occasion comment.

Pieris rapæ has been very scarce so far, probably in part at least on account of the multiplication of the *Apanteles glomeratus*, which became very abundant last year. I hardly think the explanation of a writer in one of the State papers, "doubtless due to cold weather," need be resorted to.

The Plum Curculio has scarcely been seen, but the almost total failure of the plums to set may be sufficient reason for the curculios not being noticed.

The Clover-seed Caterpillar (*Grapholitha interstinctana* Clem.), which was very abundant last year, is still numerous, but I think less abundant and destructive than last year. The Clover-seed Midge (*Cecidomyia leguminicola*) has been destructive in some parts of the State, but samples sent me have been found to produce a large proportion of parasites, and I suspect that these will soon serve to check its destructive multiplication, as in Eastern States. The samples of Clover with Midge are often accompanied with specimens of the Clover Thrips (*Phlœothrips nigra*) with the question whether they are adult midges, or sometimes

whether the red larvæ of the Phlœothrips are larvæ of Cecidomyia. The Thrips is almost constantly to be found in clover heads and it is perhaps not strange that persons unused to separating different kinds of insects, in looking for minute species in Clover heads, should be deceived by these little creatures, conspicuous from their numbers if not from their size.

The Jassidæ, occurring upon grasses, have been present in their usual abundance, and have been watched during the season especially to determine important steps in their life-history. The first point which it was our effort to determine was as to the method of hibernation. Adults of *Deltocephalus inimicus* and *debilis* and *Agallia sanguineolenta* had been taken in sheltered locations last season up to the time that winter actually set in, and with the opening of spring search was at once begun for them in such places as they were most certain to appear. The only species found, however, was *Agallia sanguineolenta*, and no specimens whatever of Deltocephalus were found. Search for adults began March 8 and continued till larvæ appeared all over grass land, and had adults been present they could scarcely have escaped notice. This seemed to show pretty fully that eggs must be deposited in fall and that the adults perished during winter if not in late autumn. To determine more certainly the place of deposition of eggs and whether adults could possibly survive the winter to oviposit, a pen was made about 6 by 10 feet in size, inclosed by boards placed close together and set down into the ground, 2 feet in height, and with all cracks or openings closely stopped, but open above to sun and rain. This was carefully examined to make certain of the absence of the adults and repeatedly searched to make sure of any introduction of Jassids. Larvæ from without could not possibly enter, as they can jump but a few inches from the ground at best and very little when first hatched, while the possibility of adults getting into this inclosure, even if any had been found in any place, were very slight indeed, and any such would have been found in the frequent examinations of the pen. As soon, however, as larvæ appeared over grass lands in general, and they appeared in millions within a few days of the time that the very first were found, this inclosure also contained larvæ in numbers. The proof therefore seems conclusive that larvæ hatch from eggs that have been deposited in the grass in the autumn or early winter preceding.

The first larvæ were seen April 23 in grass on the south side of one of the college buildings, but had not appeared elsewhere, nor did they appear in great numbers till May 12, evidently being retarded by cold and wet weather. The larvæ taken April 23 were nearly black in color and developed into *D. inimicus*, one adult being secured June 29. Larvæ of the same species of later broods are usually much lighter colored, almost whitish, with occasional individuals of darker color, and after first or second moult all present a characteristic marking, consisting of a black lateral margin to thorax and abdomen. Larvæ of *D. inimicus*

and *D. debilis*, though very similar when first hatched, are readily separated after the first or second moult by this character, *debilis* being uniformly light. Adults of *D. debilis* were first taken June 2, and appeared in general ten days to two weeks before adults of *inimicus*, though, as before stated, the first larvæ, found April 23, developed into *inimicus* by June 29.

Adults of *debilis* confined in breeding jars June 3 died in about ten days, and larvæ hatched in these jars July 5, so the period of incubation for this generation, and with breeding jar conditions, would be between three and four weeks. The bulk of this second generation are disappearing (August 12), and if larvæ of a third brood appear in two or three weeks there might possibly be four broods in the season.

Adults of *D. inimicus* were confined in jars with Blue Grass July 8, and all adults were dead about the 15th of the same month, and larvæ appeared the 25th. The period of incubation could not have been more than seventeen nor less than ten days. The first two specimens of which we have record moulted July 29, or four days after hatching; the second moult occurred August 6, or eight days after first moult. Other specimens gave second moult on 8th, 6th, 8th, 10th, and 10th of August, respectively.

Possibly there are only two broods of *D. inimicus*, but more probably three, at any rate, in seasons of ordinary length, as I believe their rapidity of development is considerably affected by weather. When ready to emerge the larva ascends some blade of grass, invariably with the head directed upward, the usual position at all times, and fastening itself to the stem, the skin splits along the center of the back and the insect emerges and the cast skins will often be seen adhering to the blades of grass some time after the moulting has occurred.

A large per cent, possibly 10 per cent, of the spring broods of larvæ were infested with small red mites, some of them almost as large as their hosts, and these likely weaken them, if not causing any more serious result, and may do a little toward checking their injuries.

Mr. Osborn then read the following notes on Kansas insects, by request of the author:

KANSAS NOTES.

By V. L. Kellogg, *Lawrence, Kans.*

The two chief insect enemies of the Kansas farmer are the Chinch Bug and Hessian Fly. No year but is marked by the ravages of these pests to a greater or less extent in some part or over the whole of the State.

The Hessian Fly (*Cecidomyia destructor*) was present in usual numbers in 1891. It has been estimated that the Hessian Fly annually curtails the wheat crop of Kansas by 10 per cent. This year (1892) this pest seems to be in unusually small numbers. The hibernating individuals

(in flaxseed stage) appear as adults about the middle of May. Larvæ and pupæ are found through June. Kansas winter wheat is harvested from June 15 to July 15.

The Chinch Bug (*Blissus leucopterus*) has been fairly numerous this year (1892), but there is no unusual amount of damage. The bug is reported from sixty-five out of the one hundred and four counties of the State. Prof. F. H. Snow has received applications this year from about 3,000 Kansas farmers for bugs infected with the contagious diseases maintained in his laboratories. Adults which have hibernated begin to appear in the fields of winter wheat about April 1. The farmers begin to complain during the last half of the month. The young bugs appear in June and during this month the serious injuries to wheat occur. At harvest time the bugs leave the wheat fields and enter the fields of young corn. In 1891 Chinch Bugs were abundant. Infected bugs were sent by Prof. Snow in 1891 into seventy-eight counties of the State. Since 1883, four years (1886–1889) have been especially marked as Chinch Bug years. The portion of the State in which the bug is especially prevalent is included between the meridians of 96° and 98° west and extends entirely across the State from north to south.

The Wheat Straw-worm (*Isosoma tritici*).—A considerable amount of injury to Kansas wheat accredited to the Hessian Fly is really done by the Wheat Straw-worm. In 1891 this insect was reported from about one-fourth of the counties of the State, being especially prevalent in central and western Kansas. Adults issued in March and April from last year's wheat straws, either in stubble or volunteer or stack, and oviposit on the young winter wheat. The adults of this brood emerge in the latter part of May and early part of June. The eggs are laid in the now maturing wheat and the larvæ pupate in the stubble or in the stack before winter. The larvæ usually lie just above the second node below the head. In a bunch of straws from Russell County over 75 per cent were infested. In these straws 40 per cent of the pupæ were found above the first node below the head, 50 per cent above the second node, and 10 per cent elsewhere. They lie in small, gnawed-out cells and the heads are almost invariably directed upward, *i. e.*, toward the head end of the straw. *Eupelmus allynii* proves an effective natural check to this pest, the parasitism being noticed in all examinations made. As but about 5 per cent of the straw-worm flies have wings the pest does not spread rapidly and local efforts in fighting it by burning old stacks and stubble containing pupæ in the winter or early spring are very effective.

The Wheat-head Worm (*Leucania albilinia*).—This pest annually does some damage in the State. The worms feed after dark, and occasionally occur in sufficient numbers to practically ruin a field of wheat. They appear chiefly in fields planted on stubble ground; wheat planted on ground which has been fallow for a year or more rarely suffers. The larvæ appear in June.

The Southern Corn Root-worm (*Diabrotica 12-punctata*).—This insect has been noted in southern Kansas. It may be working northward. The Western Corn Root-worm (*D. longicornis*) is not an uncommon pest in the State. In 1891 they were reported from many localities.

The Ham Fly (*Piophila casei*).—The packing houses of Kansas City, Mo., are seriously troubled by this pest. The larvæ, or "skippers," live in and on the smoked meats, ham and bacon. The fly is probably identical with the Cheese Skipper fly, although larvæ kept in breeding cages with ham and bacon did not take at all kindly to cheese to which they were removed. As shown by breeding-cage data, the egg stage lasts about four days, the larval stage about two weeks, and the pupal stage one week. The flies lived from six days to two weeks in breeding cages.

The Bag Worm (*Thyridopteryx ephemeræformis*).—This pest of evergreen trees is at present doing much damage in the State. Cedars and Arbor Vitæ seem especially attacked. Box-elders suffer somewhat.

Locusts (*Acridiidæ*).—*Melanoplus bivittatus* and *M. differentialis* annually do some damage in extreme western Kansas. From Hamilton County reports come of their presence now (August 1) in large numbers. The pests are attacking fruit trees, Mulberry and Catalpa trees. *Dissosteira longipennis*, which last year alarmed residents of eastern Colorado and western Kansas, is at present locally hurtful, but no serious crop destruction is threatened.

Bibio sp.—A species of Bibio closely allied to *B. femoratus*, but probably distinct from it (Dr. Williston on casual examination pronounces the species undescribed), appeared in large numbers in many Kansas wheat fields during the last week of April. It was reported from seven western counties. Larvæ were found, February 10, in large numbers in a wheat field in Pratt County; some were found also in soil in some hotbeds where flowers were growing. Adults were reported April 17 and from then constantly until the end of the first week in May. A correspondent in Lincoln County noted that pupation began about April 20, the adult flies appearing by April 27. After the adults appeared he could not find a single larva.

The flies were very abundant wherever present and occasioned much alarm. However, no injury to the wheat has been definitely traced to them. The fields most badly infested gave no signs of unusual injury. The flies disappeared suddenly and simultaneously. With the Bibios several Anthomyiid species in lesser numbers appeared. *Sciara* sp. was sent in from several fields.

Other injurious insects of the season noted are Melon Aphis (*Aphis cucumeris*), last week in July on cucumber and melon vines; Angoumois Grain-moth (*Gelechia cerealella*), attacking corn two years old in crib; last year's corn under same roof with 10 feet alleyway between was not attacked.

Discussion of this paper was deferred until the afternoon session.
The next paper was on the—

ROSE SAW-FLIES IN THE UNITED STATES.

By C. V. RILEY.

[This paper was published in No. 1 of the current volume of INSECT LIFE (pp. 6–11.)]

Association adjourned to meet at 2 p. m.

AFTERNOON SESSION.

The Association convened at 2 p. m., but at once adjourned to meet with the Society for Promotion of Agricultural Science, to be present at the reading of an entomological paper by Mr. Osborn on "Further notes on the treatment of grass insects," and also a paper on "The Harlequin Cabbage Bug," by Mr. Weed.

On reassembling, the credentials of Mr. P. H. Rolfs, of Lake City, Fla., were presented by Mr. Webster; H. A. Gossard, Ames, Iowa, by Mr. Osborn; and C. F. Baker, of Fort Collins, Colo., by Mr. Weed.

The three gentlemen were elected to active membership on motion of Mr. Forbes. The committee on address of Vice-President presented the following report:

Your committee would respectfully report that the address by the Vice-President in his résumé of the work in economic entomology during the past year be highly commended, and that his recommendation in regard to work in aquatic entomology bearing upon fish-culture, be recommended as worthy the attention of economic entomologists.

E. B. SOUTHWICK,
Chairman.
D. S. KELLICOTT,
J. B. SMITH,
Committee.

This report was accepted by the Association, as read.
The Secretary then read the following paper:

NOTES ON PLANT FAUNÆ.

By T. D. A. COCKERELL, *Kingston, Jamaica.*

Anyone who devotes himself to the study of entomology cannot fail to observe that the limits of faunæ are not always geographical in the ordinary sense, inasmuch as a genus or family of plants, or even animals, may support an insect fauna quite as peculiar to it as that of most countries or islands. The recognition of this fact has given rise to some very interesting researches, of which it is hard to say whether they are more important from the strictly scientific or the economic point of view.

Prof. Packard's recent amended Report on Forest Insects is an example of this kind of work, the value of which must constantly have been felt by every member of this Association. Even in Jamaica, where we have to deal with a very different fauna, it is continually consulted on all sorts of points and has to be placed among the two dozen or so books which are always in the workroom at one's elbow.

I have thought that this Association might suitably consider the desirability of continuing and greatly extending this kind of research, and the following notes are put together as a slight contribution to the discussion of the subject.

In the first place, we are very familiar with the fact that some insects are strictly confined to one genus or even one species of plant, while others seem almost omnivorous. In 1879 I found the larvæ of *Deilephila euphorbiæ* upon Sea-spurge in Madeira and brought some half-grown and young larvæ to England. In the neighborhood of Chiselhurst, where I was stopping, no Sea-spurge was to be obtained, and, as I could by no means get the larvæ to eat any of the Euphorbiæ that grew there, they all perished. Yet a nearly related species, *Deilephila lineata*, is one of the most promiscuous feeders among the Lepidoptera. From this and many other instances which might be given, it appears that the habits of exclusive or promiscuous feeding are not generic in their range, but vary greatly among members of a single genus.

Considering this from a Darwinian point of view, we may perhaps trace out a sort of cycle of events, comprising the rise, multiplication, decrease, and extinction of a species. This is not a suitable time for going into great detail in a matter of this sort, but briefly, I suppose the course of events may often have been as follows:

Suppose a common and widely distributed species, which lives on several plants, to be attacked by many enemies, so that it is in danger of not being able to maintain itself. The individuals living on every kind of plant will vary somewhat, and there will be a tendency for different variations to survive on different plants, owing to the fact that each kind of plant constitutes a somewhat different environment. For example, if the insect lives on the bark of trees the tendency will be for a flat variety to preponderate or survive on a tree with smooth bark and a narrow variety on a tree with crevices in the bark, etc. Now the enemies of this insect, or at least the most serious of them, will be in the habit of examining the several plants it infests, and in this examination will naturally look for most and see most readily the typical or ordinary form, not that which has begun to diverge from the normal. Consequently, the diverging races will be specially favored by immunity from attack, whatever the character of their divergence, even though not obviously protective, and the tendency will be to accentuate the differences, and ultimately to lead to the formation of a number of new species, each confined to a single species or perhaps genus of plants.

In this way, I suppose, may have arisen such species as *Deilephila euphorbiæ*, which are very restricted in their diet; and from them, perhaps without modification except in habit, those which are omnivorous.

Take now a species of restricted habits which has arisen as above described. It has had its origin through possessing certain advantages, but now that it is established it has to face new difficulties. The plant may become extinct or so rare that the individuals of it are few and far between, and dangers of this sort do not trouble omnivorous species. The means of spreading into new territories, which omnivorous species have in so marked a degree, is naturally very restricted in the case of those which can only live on one or a few plants. Added to this, the enemies which troubled the ancestor of the new species would, for their lives' sake, be obliged to turn their attention to the modified and restricted forms, the old omnivorous type having become extinct. Having done this, no doubt by a process of natural selection among themselves, these enemies would become excessively troublesome, since the supply of food would now be in each case more limited and more local in distribution, and consequently more easy to exterminate. But among the progeny of the new species there would be variations towards omnivorousness, and such would survive if the adverse conditions became sufficiently pressing, leading to the formation of a new omnivorous form, which would very possibly differ only in its omnivorousness from the type whence it was immediately derived. Such a form would, for the time being, have advantages owing to the fact that enemies had learned to look for the insect only on certain plants, and any tendency to split up would be checked by crossing and the advantage derived from continuity, so to speak, until the conditions described at the beginning of the cycle once more began to arise.

I have put this very briefly, but I hope sufficiently clearly to be understood. Hereafter I may go into further detail and give numerous instances in illustration. If insect life really does present such cycles as here outlined we can see how to account for many apparent anomalies of habit and many apparently useless specific characters.

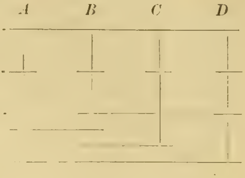
According to the above hypothesis, it is clear that, although there would be two distinct changes in the cycle, only one of them, that from omnivorousness to a special diet, would be necessarily or probably accompanied by such changes as to lead to the formation of what we should term a new species. This, I take it, is very important as explaining certain apparently anomalous facts. For example, it is not easy to see how two closely allied Lepidoptera could have been developed, each inhabiting the same two species of trees, say the Oak and the Elm, unless we suppose that originally one was peculiar to one and the other peculiar to the other tree and that both have varied towards omnivorousness. Let *A*, *B*, *C*, *D* stand for four different plants and

horizontal lines for distinct species; the three phases of the cycle may be expressed by means of a diagram, thus:

Phase 1: One omnivorous species ....

Phase 2: Four exclusive species..................

Phase 3: Several more or less omnivorous species..



The vertical lines express continuous descent.

Following on Phase 3, ordinary natural selection might eliminate all but one of the new omnivorous species, as they would evidently come closely into competition. If such elimination occurred, we should start again as in Phase 1 of the diagram; but, if, as is perhaps usually the case, the elimination was only partial when the breaking up began anew, the result would probably be an increase in the total number of species.

When classifying the fauna of any plant or group of plants, we should, according to the above hypothesis, need to distinguish two classes, as follows:

(1) An *Endogenetic* class, consisting of species which had their origin on the plant or plants under consideration.

(2) An *Exogenetic* class, consisting of species which had their origin on other plants.

I use the terms *endogenetic* and *exogenetic* as being the best I can think of at present; but I am not quite pleased with them and shall be glad if some member of the Association can substitute better ones. Other terms I had thought of were *original* and *derived*, but *original* is open to the objection that it conveys the idea that the species was always to be found on the plant, whereas, in all probability, the species of plant existed long before the particular species of insect came into existence. But, setting aside the question of terms, I think there can be no doubt that the distinction is a proper one to make, although it must be admitted that in many cases it will be very difficult to tell exactly which class a given insect should be referred to. The same difficulty meets us when we try to learn which of two countries, both inhabited by a species, gave birth to that species, but to my mind the interest of the inquiry is not lessened by the difficulties it presents.

The *endogenetic* class will, of course, have to be divided again into two subclasses, which are of extreme importance from an economic point of view:

(1*a*) The *univorous* subclass, of species still restricted to the plant on which they originated.

(1*b*) The *multivorous* subclass, of species which have become modified in the direction of omnivorousness.

The *exogenetic* species are of course all *multivorous* also, and, as regards the insects themselves, the latter division, between *univorous* and *multivorous*, is the only real one; but when we are studying the faunæ of special plants both distinctions have to be considered.

The operations of man are continually tending to change univorous species into more or less multivorous ones and to multiply the number of exogenetic species in plant faunæ. The various destructive Coccidæ, for example, *Icerya purchasi*, afford excellent instances of this and show us how we should constantly be on our guard against species which, undisturbed and in their native country, appear harmless.

It is remarkable, too, how rapidly some plants, when brought to new countries, will acquire a new exogenetic fauna. Thus, a few days ago I noticed a cultivated Chrysanthemum in Kingston badly attacked by *Lecanium* (*Bernardia*) *hemisphœricum* and *Orthezia insignis;* and an olive tree in the back yard of the museum is very severely attacked by *Aspidiotus personatus*, with *A. ficus* and *A. articulatus* in lesser numbers.

Finally, I would venture to urge that copious records of plant faunæ should be made on a careful plan. It is not sufficient to merely record the occurrence of an insect on some plant. We should be supplied with details as to locality, abundance, presence of other insects, parts of the plant infested, etc. Such details, indeed, would increase the length of the records considerably, but I believe that a few full statements are of more value than a large number of mere lists of names, for this reason, that the latter have sooner or later to be gone over again and the observations repeated in order to obtain necessary particulars.

I had intended to append a number of my notes on the plant faunæ of Jamaica, but this paper has already become too long, so I am sure you will be glad that I should refrain from doing so.

SPRAYING WITH ARSENITES VS. BEES.

By F. M. Webster, *Wooster, Ohio.*

Although much has been said with regard to the effect upon bees of spraying fruit trees with arsenites while in bloom, there seem to have been no careful experiments made for the purpose of securing exact proof, and therefore all assertions were necessarily very largely opinionative. Bee-keepers were, as a rule, of the opinion that bees would be killed by spraying the bloom, some because their bees had died, others because some one else said such results would follow. Most entomologists did not care to express an opinion based on the very little accurate information on hand, while others, including the writer, doubted the fatality of the measure, because it was thought that the poison thus applied would either blast the bloom, and thus render it distasteful, or the poison would not reach the nectar, and, being insoluble, otherwise would not affect the bees. In order to fully test the matter, the following

experiment was undertaken, being in accordance with an agreement made at the Washington meeting of the Association of Economic Entomologists, by which a series of experiments with the same object in view were to be carried on by Mr. James Fletcher, Entomologist of the Dominion of Canada, Dr. J. A. Lintner, State Entomologist of New York, and myself.

A mixture of Paris green, 4 ounces to 50 gallons of water, was sprayed on a Lombard plum tree in full bloom, at 2 p. m., April 29. The quantity of the mixture used was sufficient to wet thoroughly without dripping. The upper portion of the tree to the lower branches was covered with a square of thin brown sheeting of the brand "Utica C" and held down by ropes and stakes at the corners. The lower portion, including a space of about 8 feet square, was inclosed by mosquito netting sewed to the sheeting above and fastened below so as to prevent the escape of the bees. The ground thus inclosed was covered with the same material as the top cover. At 7.30 p. m. the hive, which had been placed near this tree some two weeks before, was moved into the inlosure and the whole secured. Dead bees began to be observed on the ground cover early on the morning of the 30th, and by 10 a. m. a considerable number had died and fallen on the cloth. Others were evidently exhausting themselves in trying to escape. At 1.30 p. m. there were a large number of dead and dying bees on the cloth, and it was thought advisable to remove the cover from the tree and allow the injured bees to escape. At 5 p. m. several hundred bees were either dead or dying, and enough were gathered from the cloth on the ground to fill a box of $21\frac{15}{16}$ cubic inches capacity, while others were clinging to the upper covering nearly or quite dead.

May 2 four analyses were made by Mr. Falkenbach, chemist of the Ohio Experiment Station, using the Marsh method, which indicates only the presenee or absence of arsenic without revealing the exact amount when present. First, a large number of the dead bees were tested and arsenic found present. Second, more bees were thoroughly washed to remove any of the poison which might have become attached to their bodies, but the presence of arsenic was clearly shown. Third, a large number of bees were washed as in preparing for the second analysis, and their bodies divided, the abdomens being analyzed separately, but the presence of arsenic was still shown, though but a mere trace. Fourth, the remainder of the bodies, less the wings, were subjected to the same analyses, and arsenic shown to be present in greater amount than in the third analysis.

The balance of the dead bees were thrown out, but several days later, during which time there had been a severe thunder shower, a considerable number were picked up and thoroughly washed, first with water and then with a weak solution of ammonia, as a still further precaution toward removing all poison from the outer surface of the bodies of the bees. The results of the analysis, however, did not materially differ from those previously made.

The second experiment was on the Apple, the colonies of bees, two in number, having been placed under separate trees several weeks earlier. Six trees were sprayed while in full bloom, four of these standing in a row, sheets 24 feet square being placed underneath each, and, in case of the two under which bees had been placed, the sheets were drawn under the hives. Two other trees a short distance away were treated the same, except that sheets were placed underneath but one. All trees were sprayed May 4 with solution, as in case of first experiment. For one week search was made each morning for dead bees, both under the trees and about the hives. At the end of this time fifty-six bees had been picked up, one of them belonging to a wild variety, and one young one had been carried out from one of the hives. Analyses of some of these showed traces of arsenic. Although bees were, on several occasions during the time given, observed frequenting the bloom in great numbers, nevertheless the weather conditions were, as a rule, unfavorable to the full activity of bees. At times there was a sharp, damp wind blowing, and at others it was cloudy with light rains. Therefore I do not consider the results gained as being satisfactory, though I believe I have shown the fallacy of attempting to get results of any value to bee-keepers by experimenting with bees in confined quarters. Also, I believe I have shown that during seasons of bad weather—that is, cold and cloudy with light rains, but insufficient to wash the poison from the trees—little or no fatal results to bees will follow spraying apple trees while in bloom. I do feel, however, that the all-important question of what the result would be if the weather conditions were every way favorable to the full activity of the bees still remains unsettled.

A third experiment was attempted on the bloom of the Raspberry, but frequent drenching rains which occurred almost daily, and often several times in a day, forced us to abandon it. I hope, however, another year to be able to present more decided and satisfactory results.

Mr. Smith said that he felt confident the bees confined on the plum tree killed themselves in their attempts to escape. He could, however, see no use in spraying while fruit was in bloom. Mr. Howard, from experiments which he had made with bees inclosed upon plants surrounded with gauze, was confident that mortality among the bees was rather the result of confinement than of the arsenical poison. Mr. Osborn thought it important to settle the question in regard to the effect of spraying on bees. Mr. Slingerland said it might be necessary to spray about the blooming season in order to destroy the Bud-worm on Apple. Mr. Lintner hoped to see the matter settled, so that people might know if it were possible to spray during the blooming season if they saw fit and without fear of injury to bees.

The following notes were presented by the author:

NOTES ON INJURIOUS INSECTS IN CANADA IN 1892.

By JAMES FLETCHER, *Ottawa, Canada.*

There have been no outbreaks of injurious insects in Canada during the past season which demand special mention.

Cutworms, usually so abundant, were very little complained of. The species most abundant at Ottawa was *Agrotis ochreogaster*. I was able to clear up part of the life-history of this species during the past season. Eggs laid by a female caught in the field during October only hatched the following spring (April 20). They were full-grown and pupated on June 10, and the first moths appeared July 20. These eggs were laid by a female of the form *ochreogaster*, and all the thirteen larvæ carried to maturity produced that form also. The larvæ from the time they first hatched had the appearance and habits of cutworms. This is one of our most injurious species in Canada, the larvæ as a rule lasting from the end of May to the first week in July. Notwithstanding the late appearance of the moth which laid the eggs above referred to, and the fact that they did not hatch until the following spring, I am of the impression that there is only one brood in a year, and that some of the larvæ hatch from early eggs in the autumn, but others not till the spring. Larvæ which are apparently too large to have grown to such a size the same season are frequently found early in the spring; but this matter requires further investigation. The moths of this usually abundant species have been remarkably rare during the present summer.

The root maggots of cabbages, onions, radishes, and turnips, have been perhaps the most destructive pests of the year. For garden application hellebore tea and kerosene emulsion applied at the roots have been successful, but for field practice I must confess that so far I have been unable to discover a practical remedy, and I lay the matter before the Association, and shall be obliged for any suggestions, as this is now a most serious matter, particularly in turnip fields.

Grass insects have received much attention. The injury known as "Silvertop" has been remarkably prevalent, and is due to several insects, primarily to small leaf-hoppers, in the stems of some of the larger grasses to *Meromyza americana*, and perhaps to a Thrips. Considerable injury has undoubtedly been done on lawns and in meadows by a Thrips which attacks the blades of grass, and leaves undoubted evidence of its presence by the very characteristic injury. The question as to whether Thripidæ attack vegetation is quite settled, so far as I am concerned. I can recognize the injury of these insects at once by the whitened tissues of the leaves dotted with dark excrementitious matter.

During the past summer Thripidæ have been most troublesome in our greenhouses at Ottawa, attacking almost every plant, but particularly

Chrysanthemums, Mimuluses, Cinerarias, and Fuchsias. The attacked leaves turn white and become distorted. Kerosene emulsion very much diluted has proved effective in destroying them.

The larvæ of *Hadena devastatrix* were abundant at the roots of grasses and did considerable harm. Several larvæ of *Gortyna cataphracta* were found attacking the young shoots of some of the large-stemmed grasses, as *Phalaris arundinacea* and *Elymus canadensis*, a curious and unusual attack by the same insect was upon the fruit of the Gooseberry. It is a regular pest every year in the stems of tomatoes, potatoes, and other succulent plants, particularly lilies. *Gortyna nitela* I have not so far found in the Ottawa district. Another species of the same genus, *Gortyna immanis*, has developed into a serious pest in the hop-growing districts of Ontario, and has been studied during the past summer. The egg is laid on the young shoots when about a foot above the ground, and for a short time the young larva bores in the center of the leading shoot and causes the distortion known as "bull-heads." After this it drops to the ground and attacks the plant at the collar just beneath the surface of the ground, and is then the "collar-worm" of hop-growers. The perfect insect, a large, handsome moth, of a rich, warm brown, shaded with darker lines, and a rosy tinge, appears during August and September, and hibernates in the perfect state. *Ichneumon subdolus* has been bred from the pupæ.

Canker-worms have been abundant in the Ottawa district on ashes and basswoods, but not on apple trees. These same caterpillars (*A. pometaria*) have again this year been injuriously abundant in Winnipeg upon the ash-leaved maples used as shade trees.

A serious attack upon grass lands, by an insect which has never before, in my experience, been noticeably injurious, was that of *Ctenucha virginica*, which was reported from Nova Scotia. The larvæ are interesting from their very different coloration during the last moult, when they are yellowish white, and the preceding ones, when they are black and white, with yellow ornamentations. *Phytoptus pyri*, the Pear-leaf Blister Mite, has been frequently complained of, and I fear is spreading in Canada.

The Zebra Caterpillar of *Mamestra picta* has been unusually abundant, and is, I believe, literally omnivorous, almost every plant being eaten by it. It has proved injuriously abundant upon cabbages, asparagus, peas and sweet peas, clover, and several trees in the Botanical Garden, as Menzies and Douglas Spruces, Willows, etc.

Another pest which has been remarkably abundant this year, is the Fall Web-worm, *Hyphantria cunea*.

Hæmatobia serrata, the Horn Fly, has at last made its appearance in Canada. First reported at Oshawa, Ontario, it has now appeared from the extreme west of the Province of Ontario down to Boucherville, some miles east of Montreal. The same exaggerated statements as to injuries caused by it have, of course, accompanied its appearance as in the United States.

Cantharis nuttalli.—I have received specimens from four or five correspondents in the Northwest Territories of this handsome blister beetle. The crop it was most injurious to was Broad Beans.

Parasites of many kinds have been particularly noticeable during the past season. The eggs of the Vancouver Island Oak-looper (*Ellopia somniaria*) were largely parasitised by a minute black Proctotrypid. A consignment of bark sent to me by Mr. W. H. Danby, of Victoria, British Columbia, showed many larvæ and pupæ which had been killed by the Entomophthorous fungus *Sporotrichum globuliferum* the previous autumn. The species hibernates in the egg form, and with one single exception all the eggs sent were parasitised by the species mentioned.

Nematus ribesii.—Since many years ago Dr. Lintner recorded finding a Trichogramma in the eggs of the Imported Currant Saw-fly, I have searched assiduously for the parasite. Until the present summer I never could find it. This year, however, I found it in three separate localities in the neighborhood of Ottawa. The first of these was near Arnprior, about 40 miles from Ottawa. The eggs of the Nematus when attached turn jet black and shining. The same thing was the case with a single egg of *Papilio turnus*, taken at Nepigon, from which I bred a swarm of minute parasites of this same genus. Egg clusters of *Mamestra picta* have also given a Trichogramma and another black Proctotrypid in large numbers.

Pteromalus puparum has been extremely abundant and useful in keeping *Pieris rapæ* in check.

Mr. Forbes said: "I do not know whether the entomologists present are all yet satisfied as to the food habits of our common species of Thrips and their relations to vegetation, about which there has been in the past a good deal of doubt. An unpublished experiment of mine, made April 23, 1889, seems, however, to settle the matter, at least so far as the common yellow Thrips, known to us as *T. tritici*, is concerned.

"There was during that year an enormous amount of the peculiar blighting of strawberries known to strawberry-growers as 'buttoning,' accompanied by a truly astonishing number of the above Thrips upon the flowers, which they sometimes almost literally covered as soon as opened, penetrating them, in fact, while still in the bud. In order to determine the effect of this Thrips' attack upon the plant, I transferred strawberry plants to pots, placing them under large bell jars in my office, and keeping them under observation for several days. Under one of the bell jars a large number of Thrips were introduced, obtained by sweeping the blossoms of pear and cherry trees. The other pot was kept under similar conditions as a check. In a short time an injury to the blossoms of the infested plant was quite manifest. It appeared first as brownish, and later as blackish, specks upon the pistil and filaments of the anthers, then upon the bases of the petals, and finally even upon the calyx and flower stem. All these parts gradually blackened and withered, the flowers sometimes drying up completely.

"As the injury began before it was possible for the seed to have been fertilized, its effect to blast the flower was evident; and as the botanists tell us that the receptacle of the strawberry will not swell out to form the fruit unless the seed develops, the connection of the Thrips with the so-called 'buttoning' seems beyond dispute.

"This species attacked in a similar way flowers of raspberries and blackberries, and with a like effect.

"I may also say concerning the relation of Thrips to 'silver-top' in Grass, that as far back as 1883 I made some studies in northern Illinois of 'silver-top' in timothy, in which I reached a provisional conclusion that this injury was sometimes due to Thrips; but as I could not verify my supposition I dropped the matter at the time. I proceeded by collecting several hundred stems of timothy in which the whitening of the heads was just beginning to show, and examined them in comparison with others clearly uninjured. A large percentage of the former contained the Thrips in numbers ranging from one to half a dozen, behind the upper sheath of the stem, usually just above the upper node, while the sound stems were almost invariably without them. Comstock's later observations on the breeding habits of the Thrips finally confirmed what was with me only a supposition."

Mr. Webster stated that a species of Thrips had attacked young onions growing in the greenhouses of the Experiment Station at Columbus, feeding on the extremities of the young tops."

Mr. Howard said that Mr. Fletcher's experience with blister beetles the present season was a common one, species having been sent to the Department of Agriculture with reports of damage from all parts of the country. He suggested that their extraordinary abundance was probably due to the great abundance of grasshoppers last year.

Mr. Forbes said that some years ago in Illinois these beetles had been exceedingly and destructively abundant following a season of great abundance of grasshoppers.

Mr. Riley presented the following paper:

AN AUSTRALIAN SCYMNUS ESTABLISHED AND DESCRIBED IN CALIFORNIA.

By C. V. Riley.

The rapidity with which the Australian *Vedalia cardinalis* has established itself in California is familiar to everyone. But the Vedalia was not the only scale-feeding Coccinellid which was sent or brought over by Mr. Koebele on his first trip to Australia in 1888–'89. Among others, he brought several species of the genus Scymnus, which in due time were set at liberty in the vicinity of Los Angeles. One of these, subsequently described by Dr. D. Sharp as *Scymnus restitutor* (Insect Life, vol. I, p. 364), was lost sight of, while another much smaller

species, originally collected by Mr. Koebele near Sydney, New South Wales (see Bull. No. 21, Division of Entomology, p. 24), turned up the present year in a rather amusing way. In the March number of *Entomological News* (vol. III, 1892, p. 51), Dr. F. E. Blaisdell describes a new Californian Scymnus under the name of *S. lophanthæ.* He found it preying on the San José Scale (*Aspidiotus perniciosus*), which infested the limbs of *Acacia lophanthæ* at the Coronado Parks, near San Diego in southern California. It is a very inconspicuous species of reddish color, the thorax often having an indefinite dark spot on the disk, and the elytra being of a blackish bronze color. The last-mentioned character is foreign to our native species of Scymnus, which never show any trace of metallic color, and, for this reason, I at once suspected, upon reading the description, that *S. lophanthæ* was one of the species introduced from Australia. Upon comparing Dr. Blaisdell's description with the sample specimens sent by Mr. Koebele from his first and second trips to Australia, I had no difficulty in identifying *S. lophanthæ* with the species from Sydney mentioned above. Subsequently Mr. D. W. Coquillett sent me a specimen, recently captured near Los Angeles, which fully confirmed this identification. Whether or not the species has been previously described from Australia I have no special means of knowing, but it does not appear to be among those described by Mr. Blackburn in 1889. (Trans., etc., Royal Soc. South Australia, vol. XI, pp. 191–198.) It is closely allied to *S. fagus* Brown, from New Zealand, and distinguished therefrom only by its finer and sparser elytral punctations and the greater extent of the pale thoracic color.

Dr. Blaisdell does not mention in his description the structural characters of the species, the more important of which are as follows: Prosternal lines long, straight, and slightly converging anteriorly; post-mesocoxal line slightly reascending externally; post-metacoxal line complete, almost reaching the first abdominal suture; elytral epipleuræ horizontal, reaching beyond third abdominal segment, slightly concave; inner marginal line not leaving the margin.

The beetle and its larva are quite abundant in the Coronado parks, according to Dr. Blaisdell; and since it also occurs near Los Angeles, there can be no doubt that this useful little Coccinellid has fully established itself in southern California.

This was followed by a short paper, being—

FURTHER NOTES ON THE FOOD OF LIMAX CAMPESTRIS BINNEY.

By F. M. WEBSTER, *Wooster, Ohio.* 1892c - aphid cat.

In INSECT LIFE (vol. IV, p. 348) are given some observations of mine relative to the destruction of Aphides by this mollusk. While the conclusions there reached, viz, "that the instance observed was exceptional and probably does not promise any particular benefit," are perhaps correct, yet some further observations may place the matter in a

better light and prove interesting to both the entomologist and conchologist.

On the same bench in the insectary where the observations were made were growing probably twelve to fifteen wild and cultivated plants, Dock being one of the former. In the course of time this last became thickly populated with Aphides, comprising for the most part apterous females and their progeny. My attention was first drawn to the matter by the fact that where these slugs were on the leaves there were great numbers of the Aphis in front of them, but very few in their rear. On placing an Aphis within the reach of one, it grasped it in its jaws and devoured it. Another and still another followed. Then after patient watching I saw it capture others without assistance.

At the other end of this bench, perhaps four yards distant, was growing probably a square yard of wheat, and adjoining this a similar plat of lettuce, which is given by Mr. Binney as one of its food-plants. The mollusks had been observed repeatedly feeding on the lettuce, of which, as the plants were large, there was always more than an abundance. But they also climbed the leaves and stems of the wheat to the height of 8 or 10 inches, and crawling along the larger leaves cleared them almost completely of the Aphidids, which in this case was *Phorodon mahaleb* Fonsc. So, then, it would seem that this food was taken of their own volition, and, indeed, they made considerable effort to get it, as they did not, so far as I could see, attack the wheat. The slugs were observed to feed as above stated only during the night and on afternoons of very dark cloudy days.

The market gardener or florist, whose interest is wholly in his plants, would, as a matter of course, be quick to observe any injury to them. The entomologist, whose eyes and mind have had a different training, would be much more likely to notice such variations in food habits. Therefore it seems to me at least possible for the much abused slug to, in part at least, repay for the injury caused by its plant-feeding proclivities by destoying other enemies of that plant. The lettuce was also infested by another species of Aphis, and, had the slugs confined their attention to them, it might have been, to some extent, an act of self-preservation, on the score of protecting its food-plant. But they voluntarily went to the wheat, upon which they did not subsist, nor was it likely that the juices of the Aphids which they ate savored of lettuce. It is entirely beyond my desire to magnify either the importance of these observations or the possible usefulness of this Limax. The desire to be just, without being unjustly just, has prompted the presentation of this whole matter.

Mr. Riley thought it an illustration of the ease with which some animals may pass from food comprising soft plants to the soft, juicy bodies of some insects.

Mr. Bethune had observed repeatedly slugs feeding on the mixture of beer and sugar used in sugaring for moths.

Mr. Howard reported good success with lime in destroying the large *Limax flavus* in gardens in Georgetown, D. C.

The committee on nomination of officers presented a report making the following recommendations:

For President, S. A. Forbes, Champaign, Ill.
For First Vice-President, C. J. S. Bethune, Port Hope, Ont.
For Second Vice-President John B. Smith, New Brunswick, N. J.
For Secretary, H. Garman, Lexington, Ky.

The report was accepted, and officers elected in accordance with the recommendations.

On motion of Mr. Weed, seconded by Mr. Howard, the matter of next meeting was left to the decision of the officers elect. Amended by Mr. Osborn, so as to instruct said officers to call the next meeting two days in advance of that of the American Association for the Advancement of Science. The motion prevailed as amended.

Minutes of the days' sessions were presented and passed upon.

After extending votes of thanks to the President and Secretary for their efforts in securing the success of the meeting, the Association adjourned.

F. M. WEBSTER,
Secretary.

REVISED LIST OF MEMBERS OF THE ASSOCIATION OF ECONOMIC ENTOMOLOGISTS.

AMERICAN MEMBERS.

J. M. Aldrich, Brookings, S. Dak.
William B. Alwood, Blacksburg, Va.
William H. Ashmead, Department Agriculture, Washington, D. C.
George F. Atkinson, Ithaca, N. Y.
C. F. Baker, Fort Collins, Colo.
M. H. Beckwith, Newark, Del.
Charles J. S. Bethune, Port Hope, Ontario, Can.
Lawrence Bruner, West Point, Nebr.
John P. Campbell, Athens, Ga.
F. H. Chittenden, Department Agriculture, Washington, D. C.
J.H. Comstock, Ithaca, N. Y.
A. J. Cook, Agricultural College, Mich.
D. W. Coquillett, Los Angeles, Cal.
A. B. Cordley, Department Agriculture, Washington, D. C.
E. W. Doran, Agricultural College, Md.
C. H. Fernald, Amherst, Mass.
James Fletcher, Ottawa, Ontario, Can.
S. A. Forbes, Champaign, Ill.
H. Garman, Lexington, Ky.
C. P. Gillette, Fort Collins, Colo.
F. W. Goding, Rutland, Ill.
H. A. Gossard, Ames, Iowa.
C. W. Hargitt, Syracuse, N. Y.
Charles A. Hart, Champaign, Ill.
F. L. Harvey, Orono, Me.
F. H. Hillman, Reno, Nev.
Geo. H. Hudson, Plattsburg, N. Y.
Geo. D. Hulst, 15 Himrod street, Brooklyn, N. Y.
L. O. Howard, Department Agriculture, Washington, D. C.
D. S. Kellicott, Columbus, Ohio.
J. A. Lintner, State House, Albany, N. Y.
Otto Lugger, St. Anthony Park, Minn.
B. Pickman Mann, Patent Office, Washton, D. C.
C. L. Marlatt, Department Agriculture, Washington, D. C.
John Marten, Champaign, Ill.
H. A. Morgan, Baton Rouge, La.

AMERICAN MEMBERS—Continued.

Mary E. Murtfeldt, Kirkwood, Mo.
F. J. Niswander, Laramie, Wyo.
Herbert Osborn, Ames, Iowa.
A. S. Packard, Providence, R. I.
Theo. Pergande, Department Agriculture, Washington, D. C.
C. H. Perkins, Burlington, Vt.
E. A. Popenoe, Manhattan, Kans.
E. Baynes Reed, Esquimault, B. C.
C. V. Riley, Department Agriculture, Washington, D. C.
P. H. Rolfs, Lake City, Fla.
M. V. Slingerland, Ithaca, N. Y.
John B. Smith, New Brunswick, N. J.
F. H. Snow, Lawrence, Kans.
E. B. Southwick, Central Park, New York City.
J. M. Stedman, Durham, N. C.
James Stimson, Watsonville, Cal.
H. E. Summers, Champaign, Ill.
Roland Thaxter, Cambridge, Mass.
J. W. Toumey, Tucson, Ariz.
C. H. Tyler Townsend, Las Cruces, N. Mex.
F. L. Washburn, Corvallis, Oregon.
F. M. Webster, Wooster, Ohio.
Clarence M. Weed, Hanover, N. H.
H. E. Weed, Agricultural College, Miss.
E. V. Wilcox, Cambridge, Mass.
C. W. Woodworth, Berkeley, Cal.

FOREIGN MEMBERS.

T. D. A. Cockerell, Kingston, Jamaica, W. I.
E. C. Cotes, Indian Museum, Calcutta, British India.
Charles French, Government Building, Melbourne, Australia.
A. Sidney Olliff, Australian Museum, Sydney, N. S. W.
Arthur E. Shipley, Cambridge, England.
W. M. Schöyen, Christiania, Norway.
H. Tryon, Brisbane, Queensland.
Eleanor A. Ormerod, Torrington House, St. Albans, England.

A CURIOUS CHRYSALIS.

We have not previously noticed the remarkable Bombycid chrysalis figured by Dr. W. J. Holland (in *Psyche*, vol. VI, No. 190, at plate 5). Dr. Holland states in the accompanying text, which occurs in one of his articles entitled "Notes upon the Transformations of some African Lepidoptera," that this is the only instance with which he is familiar where the pupa of a Bombycid moth is suspended from the cremaster, as are many butterfly chrysalids. The species is *Saturnia arnobia* Westw., and the specimens were found by Mr. Good in West Africa near the town of Kangwe. Mr. Good at first thought that he had the chrysalis of *Papilio antimachus* or *P. zalmoxis*, although the general facies was Bombycid. There were several rows of spines upon the abdominal segments and at least four large spines on the dorsum of the thorax. The color of the chrysalis was dark green, changing to pale green just before disclosing the moth. Each one hung suspended by its anal end from the twig and was partly inclosed by a few silken threads spun from one neighboring leaf or twig to another.

ABSTRACT OF PROCEEDINGS, ROCHESTER MEETING OF THE ENTOMOLOGICAL CLUB, AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

AUGUST 17-19, 1892.

Seven sessions of the Club were held in the Rochester University, Rochester, N. Y., with an attendance of 25 members and an average attendance at each meeting of 15. The following brief abstract of the papers read at the different sessions has been prepared for INSECT LIFE by the Secretary upon the resolution of the Club.

The first meeting, August 17, was opened by the President, Mr. E. A. Schwarz, of Washington, with his annual address. Mr. Schwarz took up Prof. Osborn's suggestion proposed at the Washington meeting of the club, to prepare, by coöperation, a scientific manual on North American insects. He reviewed the work hitherto done on North American Coleopterology, and pointed out that, so far as classification is concerned, a manual of Coleoptera giving synopses of genera and species can now be prepared which, in usefulness and scientific value, would compare favorably with Redtenbacher's well known work on European Coleoptera. Proceeding to the biologic branches of Coleopterology he showed that, mainly owing to the many difficulties which surround the subject, the work hitherto done is very fragmentary and in part also unsatisfactory. He concluded his address with an appeal for more work and more workers in the biology of the Coleoptera.

Mr. D. S. Kellicott presented a paper on the preparatory stages of *Calothysanis amaturaria*, showing that the larvæ of this species are very abundant during July and August at Columbus, Ohio, upon *Polygonum dumetorum*.

Mr. F. M. Webster gave some notes on the insects reared from a gall on *Muhlenbergia mexicana*, showing that six species have been reared, as follows: An Oscinid, a Pteromalid, a Eurytomid, great numbers of Lasioptera, several Polygnotus, and several Eupelmus.

Dr. C. W. Stiles discussed a cutaneous disease of cattle, in which slight lumps are to be seen along the back and flanks. Upon examination these were found to be caused by an Arachnoid, *Demodex* sp.

Prof. C. V. Riley read a paper showing that *Galeruca xanthomelæna* is polygoneutic at Washington, normally two and sometimes three broods occurring there. The greater part of the second brood hibernates, though a few lay eggs for a third generation.

The same insect was shown by Prof. John B. Smith to be monogoneutic at New Brunswick, N. J. This one brood goes into winter quarters at about the same time as the second brood at Washington.

In discussing these two papers, Mr. Riley thought the peculiar difference in habit in this species at the two places mentioned could be easily explained by heredity. Acquired beneficial characters have fixed themselves upon the species, and this explains why its habits differ so markedly in the two localities. He thought that if specimens were sent to New Brunswick from Washington they would be double brooded there, while specimens from New Brunswick would remain single brooded at Washington, irrespective of climate. He would expect, however, some deviation from the normal habit in both cases.

In a paper entitled "The Inhabitants a of Fungus," Mr. H. G. Hubbard spoke of the various insects, Coleoptera, Hemiptera, and Lepidoptera, and their larvæ, as observed by him to live in a peculiar fungus, *Cryptoporus obvolutus* Peck, which grows on burned pine logs in British Columbia. Some of these insects are merely predaceous, while others feed on all parts of the fungus and are of no special interest. More interest is attached to those species which develop within the natural cavity of the fungus. From the peculiar structure of the latter Mr. Hubbard concluded that mainly, if not entirely, by the aid of these insects (more especially *Epuræa monogama*) the spores of the fungus are transported from place to place. To the agency of another Coleopter, *Platydema oregonense*, Mr. Hubbard is inclined to ascribe the production of the peculiar filaments which form within the veil of the fungus.

In his paper on the American Bean Weevil, Prof. C. V. Riley discussed the nomenclature of this insect, and concluded that on the strict law of priority it must be known as *Bruchus obtectus* Say, until some hitherto unrecognized and unpublished name can be proved to refer to it. He treated the oviposition of Bruchus in the field, and showed that the parent insect oviposits within the pod, either using her jaws to make a hole in the pod through which to insert the eggs, or waiting until the beans are sufficiently ripe to cause a partial opening of the pod and then thrusting the eggs into the slit in masses.

Mr. Webster introduced Dr. Edward Murphy, of New Harmony, Ind., who was personally acquainted with Thomas Say for eight years before the death of the latter in 1834. Dr. Murphy gave the club an interesting account of Mr. Say, his life, peculiarities, and habits.

Mr. H. G. Hubbard's paper on Xenos gave a vivid picture of the life history and habits of this parasitic beetle from specimens obtained from colonies of Polistes kept in confinement.

The male Xenos uniformly issued from the puparia very early in the morning. They are extremely short-lived and delicate insects, being unable to stand the full light of the sun. They are further incapable of resting on account of the rudimentary development of the legs and during the few minutes of their life fly about with such swiftness that the eye of the observer would be unable to perceive their presence in the breeding cage but for the peculiar attitude assumed by the wasps.

These, imbued with a natural hatred of the parasites, are constantly on the alert and eager to catch the beetles as they dart from side to side of the cage. After a few minutes the Xenos falls exhausted to the ground when the wasps at once pounce upon it and chew it up.

This communication was greatly applauded and drew out an interesting discussion.

Mr. Schwarz read a paper on the males of the Scolytid genus Xyleborus. The males of all species of this genus differ from the females remarkably in general appearance and structural characters and have been described by Zimmerman and Leconte as different species. It is only by observation in the field that the two sexes can be recognized as belonging to the same species. A provisional synonymic list of our species was presented.

Mr. Herbert Osborn gave some notes on the species of Acanthia, describing *hirundinis*, *pipistrellæ*, and *columbaria*, the author's object being to ascertain the prevalence of these species in this country.

Mr. James Fletcher gave an account of the insects collected by him in a recent trip to Nepigon, north shore of Lake Superior, dwelling mainly on the habits and earlier stages of certain Lepidoptera and Coleoptera.

Some interesting notes on the Arthropoda of Liberia, Africa, based upon a six months visit to that country, were read by Mr. O. F. Cook.

The life history of the northern Mole Cricket was given by Mr. E. W. Doran, descriptions being given of the various stages of this species (*Gryllotalpa borealis*), with a short account of its habits in confinement.

Miss Mary E. Murtfeldt's paper on the Osage Orange Pyralid was read and will be published in full in INSECT LIFE.

Mr. E. W. Claypole gave an account of a borer (*Janus flaviventris*) in the stem of the Red Currant.

"Notes on the insect fauna of the Mississippi bottoms," by Mr. Howard Evarts Weed, gave an account of the fauna of the country adjacent to the Mississippi River, with a list of the most common species collected.

A paper entitled, "Do Termites cultivate Fungi," by O. F. Cook, discussed the Termites of Liberia and their relation to certain supposed fungi which grow in the nests of the White Ants.

Miss Mary E. Murtfeldt's paper on the Web-worm Tiger was an account of *Plochionus timidus* as an enemy of the Fall Web-worm.

The committee appointed in reference to an entomological congress to be held in connection with the meeting of the Club in 1893, reported in favor of such a congress, and the officers of the Club were instructed to invite foreign entomologists to be present at the next meeting.

The committee appointed in reference to a manual of entomology reported progress and was continued another year.

The officers elected for the ensuing year were: President, Charles J. S. Bethune; Vice-President, H. G. Hubbard; Secretary, C. L. Marlatt.

HOWARD EVARTS WEED,
Secretary.

EXTRACTS FROM CORRESPONDENCE.

Notes from Missouri.

* * * The development of the Oak Chermes seems to me very anomalous. Unless the insect has entirely eluded me all development for the season stopped at the point of hatching and dispersing. Since then, although I have examined the infested trees every few days throughout the summer, there has been no change. Occasionally a cluster of the salmon-colored larvæ may be found in a dormant condition under the scales at the base of the new growth. I infer from this that the larvæ become active very early in the spring and pass their transformations at that season when the sap flows most freely and their natural enemies are less numerous. I send examples of the most conspicuous and effective of these enemies. I also put in some other things in which you may be interested.

If you could see the ruinous work of the Osage Orange Pyralid on the hedges around Kirkwood this summer you would be better able to realize the baneful importance of the insect than you can from any description of mine.

As a rule the usual pests have not been troublesome this year, with the exception of the Codling Moth. Strange to say the Colorado Potato-beetle seems to have entirely deserted us. I have looked in vain for a few larvæ on which to test some decoctions which I fancied might prove useful insecticides, but I could not find even one. Do not infer from this that the potato crop is good, for, for some climatic reason, it never was poorer throughout this region. [Mary E. Murtfeldt, Missouri, September 6, 1892.

[In connection with the above, Miss Murtfeldt sent certain species for determination, on some of which were interesting notes, as follows:]

Exochomus tripustulatus.—This beautiful Coccinellid, if I am not mistaken, was rare in this locality until last year. It is the most important of the foes of the Oak Chermes, the larvæ tearing open the scales and feeding voraciously upon the eggs and young.

Pentaria trifasciata is an interesting little beetle, which I bred from larvæ living upon the scales of Chermes.

Chiloneurus albicornus and *Encyrtus* sp.—The most important of the Hymenopterous parasites of the Oak Chermes.

Tetrastichus sp.—I think this tiny fly is a "secondary" parasite.

Hemiptychus punctatus.—I do not know whether this beetle bred from the scales of the insect or from the twigs of the tree, but I have reason for suspecting the former.

Trichobaris trinotata var.—I bred two specimens of this pretty curculio from the woody stems of *Solanum carolinense.*

Trypeta electa Say.—The larvæ of this fly were in almost every fruit of *Solanum carolinense* last fall, destroying a large proportion of the seed. The scarcity of the weed hereabout this season may perhaps be in great measure attributed to this insect. I had a great many in rearing jars, but was not very successful in breeding them.

Phædrotoma sanguinea is parasitic on the above. It resembles species that I have found bred from the larger Microlepidoptera, but as this was from a Dipteron it may be distinct.

Parexorista sp.?—Especially interesting from the fact of its breeding in the Acorn Carpocapsa.

Piophila casei.—I have recently bred these flies from some infested ham sent me

from a packing house. The larvæ could not be distinguished from cheese skippers, and the fly, also, is very like that Piophila. Is it distinct? I can not find anything about "meat skippers" in any work in my library.

Simplosis dolichogaster.—A Gracilaria parasite.

Cecidomyia robiniæ.—The larvæ of these flies cause a gall-like thickening and curling of the edges of the leaves of Black Locust (*Robinia pseudacaciæ*).

Apanteles sp.—This species was bred from larvæ of *Colias philodice*, but seems to be the same as the Cabbage-worm parasite, although the cocoons were a much deeper yellow.

Parasite of Ceratomia on Elm; Oak Edema in Michigan Forests.

I send cocoons of a species of Ichneumon Fly produced by larvæ which emerged, September 7 and 8, from a larva of *Ceratomia amyntor* feeding upon Elm. The larvæ as they emerged were larger than the species of Microgaster commonly infesting Sphinx larvæ, and of a grayish-white color, but beyond that and the fact that it was a species with which I was unacquainted, I made no observations upon them.

The forest and shade trees in this vicinity are suffering severely this fall from lepidopterous larvæ of several species. Oaks are the worst infested and in the majority of cases the larvæ are those of *Edema albifrons*, the ravages of which are as serious as they were last fall when large tracts of oak forests were stripped quite bare of foliage.

The only remedies so far applied consist in girdling the trunks of the trees, at a height of 3 or 4 feet, with either cotton or a band of sticky fly paper. Then some persons pick off and destroy the larvæ which gather below these obstructions which they are unable to pass in their journey up the trunk. Of course this method is of value only in preserving uninfested trees and preventing the return of larvæ once dislodged.—[Robert H. Wolcott, Michigan, September 12, 1895.

REPLY.—You are correct in supposing that these cocoons are not those of the common Apanteles (old genus Microgaster) so often reared from Sphinx larvæ. They are the cocoons of *Microplitis ceratomiæ* Riley, described in a paper entitled Notes on North American Microgasters in the Transactions of the St. Louis Academy of Sciences (vol. IV, pp. 295–315). The cocoons which you send are described and figured in the *American Entomologist* for February, 1870 (vol. II, p. 128).—[September 14, 1892.]

Success of the Carbon Bisulphide Remedy against the Cabbage Maggot.

I received in due time your letter of June 7, recommending the use of bisulphide of carbon for the Cabbage Maggot. I applied, as directed, on the 11th and discovered the plants so treated very seriously wilted on the 13th. They remained in this condition for several days, but recovered from the effects of the carbon, and when cutting time came there was no difference either as to the time of heading or the number of salable heads in the rows containing three hundred and twenty-five to the row. I examined the ground and the roots of the plants and found every worm of every kind dead. My conclusion is that if the remedy had been applied at least one month earlier I might have saved the 25 per cent I lost. At the time I applied the carbon, most of the maggots had gone into the pupa state, and their course had been about run. I read the statement somewhere that muriate of potash, if liberally applied, would not only kill the young worms, but act as a fertilizer, too. Do you know this to be a fact?—[P. D. Barnhart, Pennsylvania.

REPLY.—The success of your experiments with bisulphide of carbon for the Cabbage Maggot is gratifying. We are familiar with the recommendations concerning muriate of potash, but have not, as yet, experimented with this substance.—[September 26, 1892.]

The Grape-vine Leaf-roller in Texas.

Will you please give me some information in regard to the treatment of the "leaf-roller" *Desmia maculalis?* It has utterly defoliated the grapes here. I have just come here and am unable to say how much injury it has done over the State.—[R. H. Price, Professor of Horticulture, Texas, September 9, 1892.

REPLY.—The Grape-vine Leaf-roller, *Desmia maculalis*, is two-brooded in Missouri, passing the winter in the chrysalis state. In Texas there may be more generations, but the method of hibernation should be the same. Carefully raking up and burning the leaves during the winter is a good remedy. In small vineyards the folded leaves may be picked by hand late in the season before the leaves fall, or earlier in summer the worms may easily be crushed by hand within the leaf. Such an extraordinary abundance as you indicate is unusual, and would justify the use of arsenicals in early summer.—[September 14, 1892.]

Relative Destructiveness of Cut-worms in Meadow and Pasture.

In INSECT LIFE (vol. IV, p. 400) is a note where an Iowa correspondent has mistaken cut-worms for tumble-bugs. I have had a good many years' experience with cut-worms, as I plow up more or less sod for corn every year. I have never had corn damaged to any extent on land that had been mowed, but always the damage was where it had been pastured, and the longer it had been pastured the worse the damage from cut-worms has always been. I have found fall plowing to be of some benefit, but not a remedy.

In 1891 I had a field of corn planted on sod, one-half of which was divided off with temporary fence and mowed, and the other pastured. All the meadow was fall plowed, and about one-half of the pasture around the outside; balance was plowed late in spring. The fence was removed and all planted together, May 28 and 29 (late planting pays here), on purpose to avoid cut-worms. On the meadow land there was not a hill destroyed by cut-worms, while the pasture part was all cut off several times and only escaped complete destruction by the disappearance of the worms before the corn roots were entirely exhausted. As it was the crop was damaged considerably. On the part of the pasture land fall plowed they were not quite so bad as on the spring plowed. They were mostly the brown-striped cut-worm, and disappeared about June 16.

I have given the above as a sample of my experience for the last nine years, when I first began to notice the difference between meadow and pasture with regard to cut-worms. * * *—[H. J. Giddings, Iowa, September 20, 1892.

Damage to Cattle Hides by the Ox Bot.

* * * Having been practical tanners ourselves we can testify to the immense damage to hides perpetrated by the Bot Fly. It seems to us that farmers should be systematically and vigorously reminded of the terrible loss occasioned by grub holes in cattle hides. We are constantly calling attention to this in our paper, but the Department of Agriculture has it in its power to do more effective work than ourselves. The schools and colleges of agriculture in the different States would probably coöperate in putting down this nuisance if the remedies were placed before them. We shall do our best to persuade the big packers of Chicago and other cities to remind shippers of cattle that a little more attention paid to grub holes would make the beast worth from 50 cents to $1 more. * * *—[R. C. JACOBSEN, Ed. *Hide and Leather*, Chicago, Ill., June 20, 1892.]

The Rabbit Bot.

FIRST LETTER.—I take pleasure in sending by this mail one of three larvæ taken today from the skin of the throat of a young rabbit two to two and a half months old. The rabbit appeared to have suffered a great deal of pain, as I caught it with

my hands quite easily. In this connection I would state that all the young rabbits—killed in mowing—upon this plantation, for the last two years had these larvæ about their necks. [John N. Johnson, Virginia, July 21, 1892.]

NOTE.—The specimen sent was the larva of the Rabbit Bot (*Cuterebra cuniculi*).

SECOND LETTER.—This evening I killed a rabbit about one-third grown. Between the fore limbs were two worms imbedded in the skin. The entire body except an exposed portion was covered with stiff black hairs. This part was the free end and was flush with the surface of the skin. Parting the fur at this point one might think he was looking at a warty appearance on the rabbit's skin. The rabbit was fat and otherwise in good condition.

What is this worm? Does it feed upon the rabbit or does it draw its subsistence from the outside world by means of the exposed part? * * * [W. C. Smith, Indiana, August 3, 1892.

REPLY.—The insect which you found infesting the rabbit is the common Rabbit Bot (*Cuterebra cuniculi*). This insect belongs to the family of two-winged flies known as the Œstridæ, which includes the common Ox Warble and Bot-fly of the Horse and the Sheep Bot and other similar parasites of many wild animals. It derives its nourishment from the animal itself and not from the "outside world." * * * After reaching full growth, these grubs leave the rabbit by issuing through the perforation of the skin and drop to the ground, where they transform to puparia, from which the adult flies subsequently emerge.—[August 6, 1892.]

Parasites of the Harlequin Cabbage Bug.

I send the following: (1) Small parasites on eggs of Harlequin Bug. (2) Larger do. (3) Cocoon of No. 2. (4) Eggs of Harlequin Bug. Out of over 1,000 eggs but very few Harlequin Bugs hatched. Kindly identify the parasites for me. * * * [H. A. Morgan, Louisiana, September 9, 1892.

REPLY.—It is interesting to know that you have at last reared a parasite from the eggs of the Harlequin Cabbage Bug. So far as we know, none has ever been reared heretofore, although we always supposed that these eggs would prove to be parasitised by some species of the subfamily Scelioninæ. This supposition your smaller parasite proves correct. It is a new species of the genus Trissolcus, to which Mr. Ashmead has given the manuscript name *T. murgantiæ*. It will be described in his forthcoming monograph of the Proctotrypidæ of North America. The two other parasites are, in my opinion, not to be connected with the eggs of the Harlequin Bug. The larger one is a species of Apanteles and the smaller one is a common parasite of Apanteles cocoons known as *Glyphe viridascens* Walsh. It is likely that the Apanteles was parasitic upon some Lepidopterous larva feeding upon the same leaf upon which the eggs of the Murgantia were laid and that the cocoon cluster was accidentally attached to the egg mass. You should be able to settle this point positively, however, by future observations.—[September 14, 1892.]

GENERAL NOTES.

INSECTS AND THE WEATHER.

Prof. Harrington, chief of the Weather Bureau of this Department, is preparing a work upon weather proverbs, including all the information obtainable regarding animal and vegetable kingdoms in so far as members of either give indication of changes in the weather, and has asked us for data concerning insects.

The literature of this interesting subject is not extensive, although many ideas concerning the connection of insects with the weather are current in different parts of the country, and undoubted facts have been observed relative to the instinctive knowledge which these creatures possess of changes in the weather. We therefore appeal to the readers of INSECT LIFE for assistance in this matter. Please send us any ideas current in your part of the country or any facts which you may have observed.

SUCCESSFUL COLONIZATION OF VEDALIA IN EGYPT.

In a preceding number (vol. IV, p. 349), we announced the successful arrival at Alexandria, Egypt, of a small consignment of living specimens of *Vedalia cardinalis*, the little Australian ladybird. It was hoped at the time that this insect would prove as efficient in destroying the Egyptian Fluted Scale (*Icerya ægyptiacum*) as it has been in California, New Zealand, and elsewhere against the *Icerya purchasi.* In our last number (p. 50) allusion was made to a recent report of our esteemed correspondent, Rear-Admiral R. N. Blomfield, R. N., of the success of our last consignment and of its voluntary spread from the original colony. Through the kindness of this gentleman we have recently received a communication from Mr. J. H. Marsden of Alexandria, who reports that the Vedalia is becoming very generally distributed in that region. Mr. Marsden had started near Bulkeley Station, a small colony of about a dozen specimens taken from the garden of Nubar Pasha. These were placed on a rose bush infested with the Icerya scales and soon reproduced. Fearing that their progress might be retarded owing to the rapid disappearance of the scales, search was made and a branch of an orange tree, "apparently full of the pest" was found, but on careful examination it was seen that all the Iceryas had been killed, and all of the orange trees in this garden being in a similar condition, difficulty was experienced in finding any living scales to serve as a fresh food supply. The Vedalias, however, were abundant in all stages. A month later on visiting this garden the ladybirds had also disappeared and Mr. Marsden felt confident that the pest had, in this short time, been practically exterminated. But as has been the case in other countries where introduced the Iceryas soon recovered from the first onslaught of the little destroyer, and are again at work. They are, however, accompanied by the Vedalias in one stage or another. Mr. Marsden has kindly offered to report anything that may be worthy of note in the future.

JAMAICA MUSEUM NOTES.

We have received from Mr. T. D. A. Cockerell, Curator of the Museum of the Institute of Jamaica, Kingston, Nos. 19, 23, and 24 of the stencil-process notes of the Museum. No. 19 records the finding of a new wax insect, *Ceroplastes utilis*, n. sp., which produces such an abun-

dance of wax that Mr. Cockerell deems it of commercial importance, and a new lac insect, *Tachardia gemmifera*, with which, however, the lac is not at all abundant. Number 23 records the rediscovery of Peripatus in Jamaica, and the fact that the species is being studied by Dr. Grabham and Mr. Cockerell. It has not yet been determined whether it is a new species, or whether it is identical with the Venezuelan species, *P. edwardsi*. No. 24 is entitled "New enemies of Scale Insects," and mentions particularly a Lepidopterous enemy of Ceroplastes which Mr. Cockerell thinks may be a species of Thalpochares, a Chrysopa, and a Chalcidid parasite of a Lecanium on Terminalia.

RECENT ENTOMOLOGICAL PUBLICATIONS BY THE U. S. NATIONAL MUSEUM.

Since we last mentioned the publications of an entomological nature emanating from the U. S. National Museum, there have appeared in addition (1) Directions for Collecting and Preserving Insects by C. V. Riley [Part F, Bulletin 39]; (2) Revision of the Genus Cucullia; Revision of the Dicopinæ; Revision of Xylomiges and Morrisonia, by John B. Smith (Nos. 890–892), and (3) Insects of the subfamily Encyrtinæ with Branched Antennæ, by L. O. Howard [No. 905].

GALLS IN GERMANY.

Dr. D. H. R. von Schlechtendal's important contribution to science entitled "Die Gallbildungen (Zoöcecidien) des deutschen Gefässpflanzen" has reached us under separate cover, extracted from the Jahresbericht des Vereins für Naturkunde zu Zwickau, 1891. The plan of this work comprises an arrangement of all the galls produced by animals known in Germany, according to the botanical classification of the plants which bear them. Under each plant species is given a synoptical table of its galls, running to the name of the gall insect, wherever this is known. The work is of the greatest value to students of insects, but it is surprising to notice how large is the number of cases in which the creature producing the gall has not been reared, or at least not specifically determined. When this is the case with a country like Germany, the fauna of which is so well known, American students need not feel ashamed of the condition of our knowledge in this direction. The number of the distinct galls runs up to 1,322. The work covers 114 pages and is well indexed, both zoölogically and botanically, according to the families and genera in botany and genera and species in zoölogy. Mr. Ashmead's synopsis of the Cynipid Galls is the only approach to a work of this character which we have in this country.

NOTES ON SOME BRED SPECIES OF CALIFORNIA PARASITIC HYMENOPTERA.

We have lately received from our agent, Mr. D. W. Coquillett, stationed at Los Angeles, Cal., a small lot of Hymenoptera for identifica-

tion with accompanying letter of transmittal dated September 2, containing brief notes on their breeding habits. These notes are of such interest that we take the present occasion to place some of the principal facts on record:

Monodontomerus montivagus Ashm.—Bred in August by Dr. A. Davidson, from a larva or pupa of a wild bee. Bred August 24 from a pupa of *Xylocopa* sp.

Polychroma sp.—Bred July 30 from a larva or pupa of *Chrysobothris* sp.

Pteromalus puparum.—Four ♂ ♂ and 56 ♀ ♀ specimens issued May 6 from a chrysalis of *Pyrameis caryæ*.

Praon chenopodiaphidis issued about June 10 from *Aphis rumicis* fastened to the leaf by their silken cocoons. (See INSECT LIFE, vol. IV, p. 196.)

Bracon sp. Bred with the above.

Isocratus vulgaris Walk.—Bred with the above.

Bracon sp.—Bred in May and June from larvæ or pupæ of *Tychius semisquamosus*.

Bracon sp.—Bred in May from *Thalpochares cocciphaga* received from Australia.

Limneria fugitiva Say.—Bred May 28 from a caterpillar of *Clisiocampa californica*.

A SILK-COVERED WALNUT.

Mr. Percy E. Clarke, of the U. S. Patent Office, has sent us an English walnut completely and curiously encased in a fine gray silken envelope, sufficiently dense to hide the contents. The nut was picked in this condition from a tree growing on Capitol Hill, Washington, D. C. In our opinion this silken casing was produced by the larva of the Hand-maid Moth (*Datana integerrima*), since these caterpillars have the habit of congregating together and spinning a carpet of silk during the first and second molts. That they should have thus surrounded a spherical nut, however, is somewhat strange.

NEW LOCALITIES FOR THE MEDITERRANEAN FLOUR MOTH.

This important enemy of stored cereal products has recently made its appearance in Jamaica, W. I., and in California, and it appears to be only a question of time when the species will be found in nearly all parts of the world. Mr. T. D. A. Cockerell informed us in a recent communication that he had found a "fine lot of larvæ of *Ephestia kühniella* in oatmeal bought in the streets of Kingston, Jamaica," and Mr. W. G. Johnson, of Palo Alto, Cal., sends us specimens of the same insect under date of August 30, with the information that it is making its appearance in one of the largest mills on the Pacific coast and is making rapid progress toward the destruction of the cereals in the mill.

DAMAGE BY CODLING MOTH IN NEBRASKA.

Prof. Edw. Daniels, in a recent conversation, informed us that having traveled through the State of Nebraska the present summer he felt himself in position to estimate the loss from Codling moth the present season in that State to be $2,000,000, nearly all of which might have been saved by spraying. It is an "off" year for apples, but fully enough

would set to make half a crop. As usual, however, in such years the number of insects produced by the full crop of the preceding year has been so great as to totally ruin the crop wherever spraying has not been resorted to.

SUCCESS OF A VEDALIA IMPORTATION.

We have already noted the fact that a sending of *Vedalia cardinalis*, which we made through Mr. Coquillett to Dr. Locking of Nelson, New Zealand, who had been designated to us by Mr. R. Allan Wight, arrived in good condition. We learn from the *New Zealand Farmer* of August, 1892, that the insects multiplied very rapidly, ate all of the Iceryas that were present at the original point of colonization and then migrated to the neighboring gardens, clearing off the Iceryas as they traveled. The success of this experiment was as marked in a small way as was the California importation.

Since receiving this number of the *New Zealand Farmer* we have had the pleasure of a letter from Mr. Wight giving further details. We quote a portion of the letter referring to this matter, and a second paragraph referring to Mr. Wight's own sending of Vedalia from a locality of great abundance at Whangarei, together with some comments upon the new Vedalia mentioned on page 289 of the last volume of INSECT LIFE. Mr. Wight's explanation concerning the new species is ingenious but it will require an examination from a trained student of the Coccinellidæ to settle the matter.

Dr. Locking gave me a full account of your last successful sending of Vedalia to Nelson, and I have also, since then, sent them a large consignment from Whangarei, where I found them in millions. The Nelson people have held a meeting, at which you have been very warmly thanked for your great kindness, and they have written to inform me that Icerya is very fast disappearing from their orange and lemon trees that were dying before. * * *

I think I mentioned that I had successfully sent boxes of *Vedalia cardinalis* to New South Wales, Victoria, and all over New Zealand. The harvest I found at Whangarei was a rich one, sometimes a single shake brought over 200 into my umbrella. I found that there were always a few Icerya eggs, those immediately under the mother scale, that were imbedded in so fluffy a cotton that the little beetles could not get at them, although starving, and Mr. French found that those I sent him tried to eat the mealy bug (Dactylopius) and could not do so, because the fluff clung round their legs and jaws. I also found that a large proportion of the females came out of the pupa red, without the black markings. I had often observed (as long ago as 1832–'34) that certain Lepidoptera were deficient in the black markings and that these were insects exposed to the sun in the pupa stage, and I always found the deficiency most marked where I had bred the insects in wooden boxes (in the dark). I tried the experiment with Vedalia and I found similar results, also most of those I sent to Mr. Olliff were in the pupa state (in dark boxes), and he had a great number of specimens of these badly marked ones. The female pupa exposes more of its inmate to the sun than the male, the weather, when I collected, was also very cloudy. Mr. Olliff has taken these for an undescribed species and named them *Novius wightii*, taking Mulsant's original genus, and giving me credit for a new species, but I think that he is wrong, and that it is just as I explain, but what struck me is

a mention in INSECT LIFE of Mr. Koebele's having seen (or there having been) in Mr. Olliff's possession a new species of Vedalia, and I know he had no others but what I sent him, because he was so destitute of specimens that he wanted to borrow one to make a drawing from.

QUAILS VERSUS POTATO BUGS.

Mr. E. H. Stowe, of Pompei, Mich., has been good enough to send us a clipping from the *Gratiot Journal*, in which the statement is made on the authority of Rev. J. E. Long, pastor of the Presbyterian Church of Ithaca, Mich., that "several weeks ago a pair of quails flew up out of his garden. In making the turn about the corner of the house, one of them missed its reckoning in some way, and, striking the house, fell dead. On examining its distended crop, 101 potato bugs were found, the little fellow's breakfast, for the bugs were yet alive and began to move about when brought to the fresh air."

The great value of the quail as an insectivorous bird is abundantly recognized, but we have never before met with a similar instance of voracity in a potato field.

MYRMECOPHILOUS BEETLES.

Under the title "Notes on some Myrmecophilous Coleoptera," Mr. H. F. Wickham publishes some interesting notes in *Psyche* for September, 1892 (vol. VI. pp. 321–323), on ten species of Coleoptera that are inquilinous in ants' nests in the West. *Hetærius hornii* is described as new and a number of Tenebrionidæ are mentioned as probably true myrmecophiles.

MOSQUITO REMEDIES AGAIN.

In the *Scientific American* for September 10 is published a communication from M. Kawn, of Bangkok, Siam, apropos of the note entitled "The Best Mosquito Remedy," which appeared in INSECT LIFE (vol. III, p. 223), and was republished in the *Scientific American*. Mr. Kawn states that in Siam it is the custom to place an iron nail in the water jars, since the water jars are the breeding places of the mosquitoes. The rusting of the nail acts as a deterrent and the mosquitoes will not breed in the water. For the first few days after placing nails in the water the mosquitoes continue to breed, and Mr. Kawn heats his nails red-hot, which produces an immediate effect. We are somewhat skeptical as to the success of this remedy, but are open to conviction.

An ingenious method of capturing adult mosquitoes in the house is in extensive use in some localities in New Jersey. We have not seen it described in print, and mention it here in the hope that it may be new to some of our readers. It consists in nailing to the end, or rather the top, of a stick the lid of a small tin box, such as a yeast-powder box. The stick must be long enough to enable the operator to reach the ceiling, and the tin cover of the box is nailed to it in an inverted position.

Into this receptacle is then poured a tablespoonful of kerosene, and the mosquitoes at rest upon the ceiling are easily trapped by simply placing this kerosene cup under them and close up to the ceiling. In their endeavor to escape they fall at once into the kerosene and are killed. On the morning of September 25 the writer captured in this way seventy-five mosquitoes on the ceiling of the room which he had occupied during the night. Most of the seventy-five were filled with blood, which, we think, is a sufficient argument in favor of performing the operation before going to bed rather than after arising! This was at Montclair, N. J.

NEWSPAPER ENTOMOLOGY AGAIN.

Even the apparently truthful and perfectly circumstantial stories which appear as press dispatches in the columns of some of our best newspapers will bear investigation. A prominent New York daily, for instance, in the early part of September, published a dispatch from Newark, N. J., stating that five horses had died from the attacks of Texas Flies (meaning, doubtless, the Horn Fly, *Hæmatobia serrata*). As this insect does not infest horses, and as the death of an animal from its direct attack has not hitherto been substantiated, we wrote to the gentleman whose name and address was given, and received the following statement from Dr. James D. Hopkins, veterinary surgeon, of Newark, which indicates that our preconceived ideas in regard to the truthfulness of the dispatch were correct:

> Mr. ——— ——— lost five horses, two from heat and three from colic or enteritis. I attended three of them; the other two died before aid could be summoned, but the history of the case indicated plainly the cause of death. Mr. ——— ——— talked a good deal about the sudden and peculiar deaths of his horses, and the newspapers made a mess (as usual) of it, although I gave them full information on the subject.

WIDESPREAD TROUBLE FROM THE HORN FLY.

It is remarkable with what rapidity the Horn Fly (*Hæmatobia serrata*) has spread over the country. All through the Northern States and up into Canada it is becoming a grievous pest. We spent some time during August on the shores of Lake Ontario, and it was piteous to see the suffering of the cattle along the highways. In many instances farmers were obliged to cover their animals to give them partial protection. Our old friend, Dr. Charles Mohr, of Mobile, Ala., informs us that he has been much pestered by what he calls a new fly, which has appeared this year in vast numbers in Mobile, and from his description we have no doubt that the fly is the one in question. Reports have come to us from quite a number of places in the north. Mr. Fletcher and Dr. Bethune, as appears in the minutes of the Association of Economic Entomologists, report it at various places in Canada, and in addition to the localities mentioned on page 49 of the previous number, and we have received specimens from Fort Plain and Upper Jay, N. Y., Fairfield, Iowa, Harris County, Tex., and Brandon, Vt. The extremely rapid spread of this

insect all over the country is additional evidence of its importation from Europe although we have previously practically settled this point, showing, in 1889 (INSECT LIFE, vol. II, p. 96), that it was probably first imported in the year 1886 in the vicinity of New York City. It is interesting to note how generally the popular name "Texas Fly" or "Texas Horn Fly" is applied to this insect throughout the North. This is an unfortunate cognomen and indicates an entirely erroneous idea of its origin.

THE TANNIN IN A SUMACH PLANT-LOUSE GALL.

We are informed by Prof. Henry Trimble, of the Philadelphia College of Pharmacy, that the gall of *Pemphigus rhois* Fitch upon *Rhus glabrus*, specimens of which he sent us for determination, contains nearly as much tannin as the ordinary commercial Cynipid gall from China and Japan, viz, from 60 to 70 per cent. While this fact may not prove of commercial value, it is interesting to know that the galls contain three times as much tannin as the foliage of the Sumach, the action of the insect seeming to concentrate the tannin of the plant in the gall formation.

THE FEMALE REAR-HORSE VERSUS THE MALE.

It is a well-known fact that the male insect of the family Mantidæ approaches the female at the risk of his life. Several instances have been recorded where the female has devoured the male, and we have reason to believe that many similar unrecorded observations have been made. In *Science* (vol. VIII, p. 326, Oct. 8, 1886) we described an instance in which the male gained connection with the female only after his head, front legs, and one-third of his thorax had been devoured, and we surmised that the act of copulation might ordinarily take place while the female was making a meal of her unfortunate mate. This, however, seems not to be the invariable rule. Col. John Bowles, of Washington, D. C., brought us on the 8th of September a pair of *Stagmomantis carolina*, which he had carefully watched. When he found them they were *in copula* and the male was uninjured. While he watched, however, the female turned her head and began to rapidly devour the head of the male. The male remained perfectly quiet and made no effort to escape. She ate up his head, his front legs, and was busily engaged upon his thorax, when Col. Bowles, wishing to save the specimens in that condition, killed her by painting her head with a camel's hair brush dipped in chloroform. The observer supposed that the male was already dead, but immediately upon the death of the female the mutilated male made violent efforts to escape, but before he succeeded in doing so he was pinned by Col. Bowles in the normal position and the specimen was brought to us. The nonchalance with which the male devoted himself to the sacrifice and the struggles which he made immediately upon the death of the female indicated to Col. Bowles' mind that the male has no serious objection to this method of suicide.

TICKS IN THE LEEWARD ISLANDS.

In the supplement to the Leeward Islands Gazette of April 28, 1892, is published an interesting article entitled "Notes on Ticks," which comprises a general summary of the habits of these parasites on domestic animals, and a somewhat extended series of notes on *Ixodes ricinus*, which is followed by an article on the connection between ticks and cattle disease, in which the recent investigations of the Bureau of Animal Industry of this Department are summarized.

ENTOMOLOGICAL SOCIETY OF WASHINGTON.

October 6, 1892.—Theodore Holm, Department of Agriculture, Washington, D. C., was elected an active member. The following were elected corresponding members: Prof. J. W. Jenks, Brown University, Providence, R. I.; T. D. A. Cockerell, Institute of Jamaica, Kingston, Jamaica; Miss E. A. Ormerod, St. Albans, England; W. Jülich and A. Luetgens, New York City; Prof. S. A. Forbes, John Marten, and C. A. Hart, Champaign, Ill.; Prof. C. W. Hargitt, Syracuse, N. Y.; Prof. T. Thorell, Montpellier, France; Prof. W. Kulszynski, Cracow, Austria; A. D. Hopkins, Morgantown, W. Va., and Dr. F. W. Goding, Rutland, Ill.

Upon a special invitation Mr. Hopkins gave an account of a recent visit to Europe for the purpose of studying certain Scolytidæ injurious to pine trees. He had brought back with him a large number of specimens of the European *Clerus formicarius* alive for the purpose of introducing them into pine forests in West Virginia infested by *Dendroctonus frontalis*. Discussed by Messrs. Riley, Howard, and Marlatt.

Mr. Ashmead presented a paper upon the Eucharidæ of the United States, and exhibited specimens of a number of species of this group which was formerly placed in the Chalcididæ, but which he thinks is entitled to family rank. Discussed by Messrs. Riley and Howard.

Prof. Riley presented some miscellaneous notes, reading at length from a letter received from Dr. Borries, of Copenhagen, upon the evidence of phytophagic habit in two species of the Chalcidid genus Megastigmus. He also read extracts from a communication from Prof. J. B. Smith, who had found the eggs of a second brood of *Galeruca xanthomelæna* at New Brunswick, N. J. This, Prof. Riley said, was in accordance with his anticipations; and he further stated that eggs of this species were now being laid in the District of Columbia, these being deposited by the fourth brood of beetles, counting the hibernating beetles as the first brood. These notes were discussed by Messrs. Howard, Ashmead, and Marlatt.

Under the order of short notes and exhibition of specimens Mr. Ashmead exhibited the plates of his forthcoming monograph of the Proctotrypidæ of North America.

Mr. Heidemann showed a large series of specimens of *Rheumatobates rileyi* Bergroth, including males, females, and immature specimens, which he had found during the previous week in the Chesapeake and Ohio Canal, near Washington. The only known specimen of this insect up to the present time was captured by Rev. J. L. Zabriskie, near Flushing, Long Island, and was figured in Insect Life, vol. iv, p. 199. He called attention to the structural peculiarities of the female sex, which differed in certain respects from the male, as shown in Insect Life.

E. W. Doran,
Secretary pro tem.

O

U. S. DEPARTMENT OF AGRICULTURE.

DIVISION OF ENTOMOLOGY.

PERIODICAL BULLETIN. Issued January, 1893.

Vol. V. No. 3.

INSECT LIFE.

DEVOTED TO THE ECONOMY AND LIFE-HABITS OF INSECTS, ESPECIALLY IN THEIR RELATIONS TO AGRICULTURE.

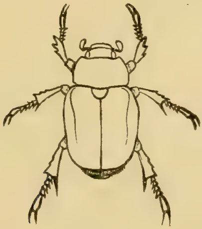
EDITED BY

C. V. RILEY, Entomologist,

AND

L. O. HOWARD, First Assistant,

WITH THE ASSISTANCE OF OTHER MEMBERS OF THE DIVISIONAL FORCE.



[PUBLISHED BY AUTHORITY OF THE SECRETARY OF AGRICULTURE.]

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1893.

CONTENTS.

SPECIAL NOTES.

A Text-book of Agricultural Entomology.—We have just received from Miss E. A. Ormerod a copy of her new "Text-book of Agricultural Entomology," which has just been published by Simpkin, Marshall, Hamilton, Kent & Co. (Limited), London, 1892. The first edition of this text-book was published in 1884, and consisted of ten lectures delivered in 1883 at the Institute of Agriculture of South Kensington. The first edition met with almost no sale until last year, when attention was drawn to it as conveying information in one of the branches of agricultural instruction brought forward under the arrangements of the new County Councils, and it then sold off so rapidly as to necessitate the preparation of a second edition. In a handy volume of two hundred and thirty odd pages Miss Ormerod has condensed a great deal of information which will be useful to English farmers and fruit-growers, and has illustrated her text by over 160 figures, 50 of them being drawn from life, while the others are taken from previous publications. The arrangement of the work is on the plan of the little Italian work of Dr. Franceschini, which we reviewed some time ago. In other words, instead of arranging the subjects under the crops which they infest, they are arranged according to zoölogical classification. Chapters I and II are devoted to a consideration of the different states and the classification of insects; chapters III and IV to injurious insects of the order Diptera; chapters V and VI to the Coleoptera; chapters VII and VIII to the Lepidoptera and Hymenoptera, respectively; chapter IX to the Homoptera, and chapter X to the Mollusca and Anguillulidæ, etc. The latest remedies known to the author are usually given. English horticulturists have not taken up the arsenical poisons so widely used in this country until the last year or two, but Miss Ormerod recommends them for leaf eating caterpillars in the orchards, although she does not give proportions and methods of application on account of the necessity for restricting the size of her volume. She covers the point, however, by offering in a foot-note to send a pamphlet giving all necessary details to all applicants gratuitously. The emulsions of kerosene and soap are mentioned only incidentally, and no space is given to the important subject of insecticide machinery. In spite of these omissions the work is a most convenient one and will serve to extend a knowledge of injurious insects among the class of people who most need this information.

Food of the Robin.—In Bulletin 43 of the Ohio Agricultural Experiment Station Mr. E. V. Wilcox summarizes his recent extensive investigations upon the food of the Robin. We have previously noticed a preliminary article upon this subject, published in the Journal of the Columbus Horticultural Society. In this later paper Mr. Wilcox reviews the literature of the subject, critically examining the statements of S. A. Forbes and F. H. King, and tabulates the stomach contents examined by himself. These are 60 of birds shot in April, 18 in May, 49 in June, 45 in July, and 15 in August, a total of 187 in all. The totals of insect contents are as follows: 52.4 per cent of beneficial species, 18.6 per cent of injurious species, and 28.9 per cent of neutral species. The question of damage to fruit is considered, and in summing it up Mr. Wilcox concludes that the fruit-grower should be allowed to kill the Robin during the season when it is most harmful, and should not, as at present, be in danger of arrest and fine for shooting these birds in his own garden. In arriving at this result he allows for the possibility that, as contended by Forbes, the services of the predaceous beetles which the Robin destroys have been overestimated. Following this paper by Mr. Wilcox are some remarks by the Horticulturist of the Station, Mr. W. J. Green, in which the fondness of the Robin for berries is shown, and the sensible point is made that whatever the services of the Robin to the public in general may be, the tax upon berry-growers is too great for them to bear alone. Following Mr. Green's remarks is a statement from Mr. F. M. Webster, Entomologist of the Ohio Station, giving the results of the examination of 14 stomachs of birds shot in meadows, Mr. Wilcox's specimens having been mainly taken from birds shot in a fruit-growing section. Mr. Webster shows that although the larvæ of crane-flies were very abundant in the fields in which the Robins were killed, only 3 of the 14 had eaten these larvæ and only 1 had made a full meal of this food. He generalizes from this that while Robins get from grasslands in April and May a large part of their food, it has so far proven to consist mainly of insects of whose destructive propensities we have as yet no proof. The trouble here is, however, that Tipulid larvæ are so soft that remains are not apt to be found unless they were recently swallowed.

A Bulletin from Oklahoma.—Bulletin 3 of the Oklahoma Agricultural Experiment Station, published June 3, 1892, contains 20 pages of insect notes by the Director of the Station, Dr. J. C. Neal. The bulletin is entirely compiled, and treats of the Imported Cabbage Butterfly, the Cabbage Plusia, Cut Worms, the Boll Worm, the Striped Melon-beetle, the Twig Girdler, the Chinch Bug, the Horn Fly, and the different formulas for insecticides.

North American species of Tachytes.—Mr. W. J. Fox, of Philadelphia, has just published a monograph of the North American species of Tachytes in the Transactions of the American Entomological Society, August, 1892. The paper covers pages 234 to 252 of the nineteenth volume of the Transactions, and is illustrated by Plate XI. Mr. Fox has found 23 species of this interesting genus in North America, and these he separates by means of useful synoptical tables of both sexes, re-describing all of the old species and adding a number of new ones. Mr. Fox has been taking up one genus after another of the Fossorial Wasps, and has also recently monographed the Larrid genus Astata in the current volume of the *Canadian Entomologist* (pp. 232–235).

Who are the Readers of Insect Life.—Some months since, wishing to reduce the mailing list for INSECT LIFE and weed out those who were not specially interested in the publication, a circular was sent out asking the return of a card, properly filled out, by those who still wished to have the publication sent to them. One of the questions asked was concerning the occupation of the individual. The cards are now about all in and the tabulation of this matter of the occupation of those who have shown enough interest in entomology to wish to continue the receipt of INSECT LIFE is interesting and suggestive. As might be expected, farmers, fruit-growers, and gardeners head the list in point of numbers. Of these there are 1,076; of periodicals, libraries, scientific societies, etc., there are 669; of entomologists and naturalists in general there are 583; teachers, including college professors, 285; physicians, including veterinarians, druggists, and dentists, 153; persons engaged in mercantile pursuits of all kinds (general merchandise, real estate, insurance, clerks, etc.), 157; students, 124; literary men, including editors, journalists, publishers, and reporters, 63; mechanics, artizans, and laborers, 41; Government employés, at Washington and elsewhere (except Department of Agriculture), 40; clergymen, 29; lawyers, 27; chemists, 20; engineers, mining, civil and electrical, 17; bankers, 7; artists, 6; geologists, 6; poultrymen, 5; architects and landscape gardeners, 4; horticultural inspectors, silk culturists, bee-keepers, U. S. Army and retired, 3 each; comptrollers, and inspectors of insect pests, 2 each; artificial-fly maker, bar-keeper, barber, butcher, capitalist, carpet layer, compositor, clerk of court, commissioner of agriculture, commissioner of horticulture, contractor, cigar maker, dealer in surgical instruments, engraver, member of foreign legation, ice dealer, inspector of grain, inspector of customs, jeweler, kiln burner, Member of Congress, miller, music dealer, milkman, policeman, restaurateur, stockman, superintendent children's aid society, telegraph operator, sculptor, watchmaker, agent, 1 each.

It is probable that nearly all of the correspondents who occupy themselves with commerce and professional pursuits, aside from teaching,

derive their interest in INSECT LIFE through the possession of a garden or farm, so that the publication measurably reaches just the class of people for whom it is intended. This statement is not founded upon guess-work since many of these individuals have made such statements to us in correspondence, a number of bankers and merchants having stated that they own farms.

An interesting case is that of a merchant in Connecticut, who writes that he keeps an "old-fashioned country store," and that a large number of his customers are farmers and others who own homes, and are interested in fruit and berries. He keeps a file of INSECT LIFE at his store for the benefit of his customers.

The expressions of interest in the publication and the estimates of its practical value have been very gratifying, and we take this occasion to thank our readers for their kind words and for their prompt replies to the circular.

THE GLASSY-WINGED SHARP-SHOOTER.

(*Homalodisca coagulata* Say.)

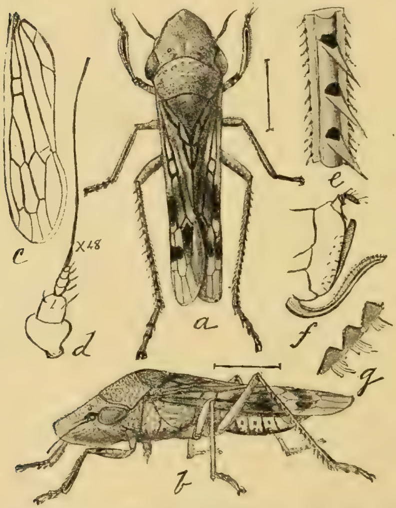


FIG. 10.—*Homalodisca coagulata:* *a*, adult ♀ seen from above; *b*, same, side view; *c*, venation of fore-wing—enlarged; *d*, antennæ; *e*, section of hind tibia; *f*, ♀ genitalia—still more enlarged; *g*, serrations of ovipositor—still more enlarged (original).

There is a not uncommon leaf-hopper of the family Cercopidæ, found chiefly in the South, which occasions much damage to vegetation, but the depredations of which have not been recognized by writers

upon economic entomology. This is *Homalodisca coagulata*, a species described by Say in 1832 from specimens captured by Barabino in Louisiana. It is generally known as the "Sharp-shooter" in the South, on account of the peculiar effect of its puncture on young cotton bolls, which look as though pierced by a minute bullet, and also because of its rapid and forcible ejection of minute drops of liquid. It is a large species, nearly half an inch in length, and somewhat resembles the common *Proconia undata*, a species common in the Southern States and which is frequently responsible for the "weeping trees" to which we have several times referred in the pages of INSECT LIFE. The two species are, in fact, often associated with each other on the same plant and are commonly confounded. The species under consideration, however, may at once be distinguished from the Proconia by its more elongate snout and by the more shining and glassy appearance of its wing-covers, as well as by many other minute but more important structural characters.

In July, 1885, we received specimens of the Homalodisca from Mr. L. C. Bryan, of Savannah, Ga., who had found it injuring the LeConte Pear. Mr. Bryan described it as being very shy and difficult to catch, and stated that it sucked the sap from the pear leaves. He mentioned it also in an article entitled "What is to be the future of the LeConte Pear," in the *Savannah Weekly News*, of about July 16, 1885.

In August, 1887, other specimens were received, together with a few of *Proconia undata*, from Mr. C. F. A. Bielby, of Deland, Fla., who found them in considerable numbers upon the twigs of the new growth and that of the previous year in an orange orchard affected by "die-back." Mr. Bielby had watched them most carefully and described their extreme shyness and their interesting habit of ejecting a spray of fluid from the anus. He could not see them feeding on the twigs, but strongly suspected that they were, at least in part, responsible for the "die-back." In later letters he stated that he had seen the insect insert its beak into the young wood, and surmised, from the color of the fluid contents of the abdomen, that it fed upon the yellow essential oil. This correspondence with Mr. Bielby is published in full in INSECT LIFE, vol. I (pp. 52–54). As there stated in our published answers, it is impossible to connect the punctures of this or any other orange-feeding insect with the disease known as "die-back." Even the so-called "die-back fungus" is secondary in its attack, and the disease itself is probably physiological, or rather not caused by any parasite, either animal or vegetable.

In June, 1891, we again received specimens, and this time from Mr. Louis Biediger, of Idlewild, Bexar County, Tex. Mr. Biediger wrote us that he found them upon his wild mulberry trees and that the trees were "full of them." Up to the time of writing (May 29, 1891) he had not been able to see that they had caused any appreciable damage.

In August of the present year (1892) still other specimens of the

same insect were received from Mr. L. Donner, manager of the Halls Island Farms, near Beaufort, S. C., who had found them upon his asparagus plants.

A little later our old-time correspondent, Judge Lawrence C. Johnson, wrote us from Meridian, Miss., under date of September 25, and transmitted among other entomological specimens a single female of this species taken on a cabbage stalk.

During the summer of 1891 two of our assistants, Messrs. F. W. Mally and Nathan Banks, while engaged in the Boll-Worm investigation at Shreveport, La., found that this species is largely responsible for a somewhat peculiar damage to cotton, known locally as "sharpshooter" attack. Under our instructions these gentlemen made a careful study of this particular damage, and from their reports we gain the following information:

In Louisiana this species is quite abundant upon the cotton plants in certain fields from the first of June on through the season. The fields in which it is most abundant are those bordered by young poplars along the bayous. Prior to the first of June the insect occurs upon the poplars. About that time, however, the young growth becomes so hard that they migrate to cotton, which crop they damage by feeding and by oviposition. As shown in the figure, the ovipositor of the female (Fig. 10 *f*) consists of two saw-blades, and with these she punctures vegetable tissue for the reception of her eggs. Upon cotton the eggs are most frequently laid within the young forms or squares. Mr. Mally observed the act of oviposition twice, and describes it as follows:

> The female braced herself upon all legs, the head and anterior portion of the body elevated. The very thin pointed ovipositor was then exserted, and by a forcible sawing-like operation was gradually inserted underneath the epidermis. The channel was made concave, the distal end almost coming to the surface again. The long, slightly curved, cylindrical white egg was then introduced, and the ovipositor withdrawn. The time occupied by this process was about one or two minutes. After a short interval a second egg was laid in like manner alongside of the first, but slightly in advance of it. A few hours after deposition slight, pale, blister-like swellings were noted over the points where the eggs were found.

The duration of the egg state was not ascertained. The newly-hatched young was noted and was found to be nearly white, carrying its abdomen elevated almost at right angles to the body. It is shy, like the more mature individuals, and hides among the very young leaves or the involucres. In this stage the insect feeds by puncturing the epidermis at the base of the flower bud, or the very young bolls, or the short, tender peduncles. After this puncturing the form or small boll "flares," turns pale, and drops off, the only indication of damage being a small black spot, and it is these spots which the planters call "sharp-shooter" work. By many this damage has been attributed to the Boll Worm, and attention was drawn to it many years ago by Glover, who, however, did not ascertain the real perpetrator of the damage, considering it to be probably the work of some heteropterous insect.

The young molt several times before gaining wings, and in the specimens in the collection about seven stages, without counting egg and adult, are found. The characteristic elevation of the abdomen persists in the pupa state, becoming, however, less marked as the insect grows older. It persists, however, to a slight extent in the adult, which thrusts its abdomen out from beneath its wings and turns the tip slightly upwards in discharging the drops of saccharine liquid common to many of the members of this group of insects. With each successive molt the insect becomes darker, and the pupa is bluish or lead-colored and runs about the plants with much more freedom than when younger. The full-grown insects are found most frequently upon the central stem of the plant. As noted by all of the observers who sent in specimens, they are very active and shy, running up and down the stalk and dodging from side to side.

The adult insect is brownish, sometimes tinged with bluish. The wing-covers are glassy and shiny, being nearly transparent near base, and becoming smoky for the outward three-fifths. There is a large reddish blotch just beyond the middle and near the anterior border. Fresh females often have a white powdery spot superimposed upon this reddish spot. This white spot is easily rubbed off, and is not apparent after the insect is a few days old. It is probably waxy in its nature. The head and thorax are mottled with dark brown and honey-yellow, and the abdomen, as seen from the side, is marked with large yellow bands, the spiracles remaining brown. The under part of the body is in general honey-yellow, somewhat mottled with brown. In flying from plant to plant the insects make a slight but distinct buzzing sound. When feeding they rest head downwards upon the central stem and incline the tip of the abdomen outwards, ejecting when in this position several drops of liquid in quick succession. In spite of the shyness of the insect, the female is not readily disturbed when ovipositing. A specimen dissected by Mr. Banks on July 15 was found to contain 19 eggs. The observations of Messrs. Mally and Banks indicate that there are certainly two, and possibly three, broods during the season. The adults make their appearance in numbers about June 1, and by the middle or latter part of June many young are found. The second brood begins ovipositing about the latter part of July, and after the first days in August the adults become less abundant. Experiments made indicate that while the males are readily attracted to light, the female is very rarely caught in this way. For instance, of 22 specimens trapped, 20 were males and 2 females, and on July 19, of 9 specimens caught at light all were males. Upon the cotton plants, however, there were usually more females than males, and this was the case at the very times when the lamp experiments were being made.

We are, unfortunately, not familiar with the method of hibernation, and unless this, when ascertained, should afford some ready means of destroying the insect, the best remedy will consist in the application of

dilute kerosene emulsion. The tarred-shield method in use against the leaf-hoppers of the family Jassidæ, and particularly the Typhlocibins of Erythroneura and allied genera, will not avail here, since, as already indicated, the insects do not fly out from the plant when disturbed, as does the Grape Leaf-hopper, for instance, but simply hide behind the stalk or twig upon which they have been feeding.

Where "sharp-shooter" work is prevalent in a cotton field it will probably pay to make a single application of the emulsion to the young poplar growth along the borders of the field about the second week in May. Many individuals will thus be killed which would otherwise migrate to the cotton plants and lay their eggs for a new generation. It will also pay the cotton-grower to cut down a large part of the young poplar growth along the streams and bayous, so as to concentrate the insects as much as possible. It is important to note in this connection that the insect is absent, or very rare, in cotton fields which are not contiguous to poplars. The insect will always be difficult to fight on account of its numerous food-plants, but a restricted garden crop like asparagus, of sufficient value to warrant the expense, can be protected by an occasional thorough spraying.

The discharge of drops of liquid by the pupa and adult is a most interesting habit and is common to a large number of leaf-hoppers of the family Cercopidæ, varying, however, in degree. *Proconia undata* and the species under consideration seem to have been most frequently noticed, both on account of their more copious discharge and on account of the abundance of the insects. The liquid is thrown out from the anus in several small drops, frequently in an almost continuous spray. The discharge is most copious when the insect is disturbed, and there seems to be an effort to throw it in the direction of the intruder, so that it probably acts as a defense against natural enemies. No scientific observations have been made upon this secretion. It is too abundant to be secreted by specialized glands, and it is doubtless simply the excremental fluid of the insect. It is rather whitish when it dries upon leaves below the insect, and is slightly saccharine, although it does not seem to have as great an attraction to bees, wasps, and ants, and other honey-lovers, as does the secretion of plant-lice and certain of the larger scale-insects.

In INSECT LIFE (vol. I, pp. 52–54) we have published in full the correspondence with Mr. Bielby referred to above. Mr. Bielby's observations have been very careful and he gives an interesting account of the habits of the adults with some details regarding the liquid secretion. In volume II (pp. 160–161) we noticed a newspaper article regarding weeping trees, the remarkable phenomenon proving to be caused by the abundance of *Proconia undata*, while in volume III (p. 415) we published an interesting account of another weeping tree from a Mississippi correspondent, Mr. R. J. McGuire.

THE OSAGE ORANGE PYRALID.

(*Loxostege macluræ*, n. sp., Riley.)

By MARY E. MURTFELDT, *Kirkwood, Mo.*

To begin with a premise which no one æsthetically cultured will controvert, no fence of any sort, be it massive wall or delicate tracery of iron work, can compare in beauty and in harmony with the general features of a landscape with a well-kept hedge; and the Osage Orange is preëminently the hedge plant of the United States. True, it does not thrive in very northern latitudes, but in all other sections, from southern Texas to northern Iowa, it adapts itself readily to all varieties of soil and surface, and, with far less care and in a shorter time than any other shrub, it forms a beautiful, luxuriant, and impenetrable barrier.

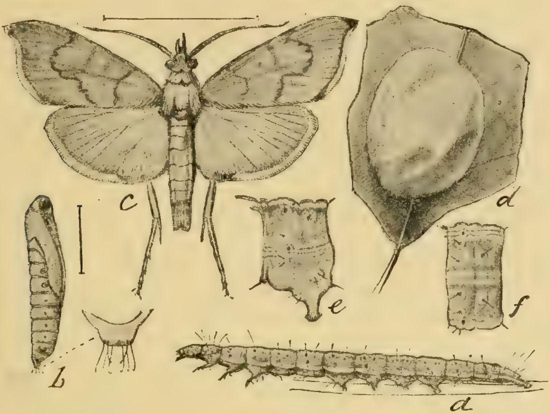


FIG. 11.—*Loxostege macluræ: a* larva; *b*, pupa; *c*, adult; *d*, cocoon—enlarged; *e*, side view of abdominal segment of larva; *f*, dorsal view of same—still more enlarged (original).

Hitherto one of its especial merits has been its comparative immunity from insect attacks. Occasionally it suffers, in common with soft maples, grape-vines, elms, and some other trees and shrubs, from the Coccid, *Pulvinaria innumerabilis*, while it is annually preyed upon, to some extent, by various Orthoptera, among which the Margined Cricket (*Nemobius marginata*) is at times conspicuously destructive. The pretty little leaf-hoppers, *Flata conica* and *Pœciloptera pruinosa*, especially the former, may be seen in summer ranged in close ranks along the tender shoots, which are weakened and distorted by the innumerable punctures. The Tortricids, *Teras pastiana*, *Cacœcia rosaceana*, and *Lophoderus triferana* web and curl a few of the leaves and a handsome Cerambycid, *Dorchaschema wildii* bores the older wood, sometimes to the extent of killing an entire plant, but, until two years ago, it has never, to my knowledge,

had an insect foe peculiar to itself. In the late summer of 1890 the hedges in and around Kirkwood and throughout St. Louis County gave evidence of some unusual insect work. The leaves were somewhat webbed and eaten into holes so numerous and close together that they had the appearance of very open-meshed lace. Of many only the midrib and larger veins remained. Repeated examinations failed to reveal any insect in numbers at all corresponding to the amount of damage, and for that year the depredator escaped recognition.

Last September, however, the mystery was solved by the discovery, on the under side of a leaf, of several slender, watery-green larvæ of Pyralid affinities, extended close to and along the veins. Having once obtained a clue to their appearance and habits they were found to be very numerous and of all sizes, from those only one-eighth inch in length and no thicker than a thread, to those three-fourths of an inch long by one-tenth in diameter. The colors are remarkably imitative. Up to the third molt they are of a whitish translucent green and it is almost impossible to distinguish them stretched out along the veins of the under surface. After the last larval molt they assume the pale grayish indistinctly mottled color of the bark of the mature wood of the plant. These colors, in connection with their habit of feeding only at night and of retiring during the day to the interior of the hedge, where the young rest in security on the under sides of the leaves, while those more nearly mature stretch themselves along the stems, render them among the most illusive of larvæ, and after I had reared them in the breeding cage as well as carefully noted their traits in the open air, I was not surprised that they had for so long successfully evaded detection in spite of the evidences of their presence in the ragged and sickly appearing foliage.

There are two distinct broods annually, but the moths issue irregularly, live for a considerable time, and the larvæ grow rather slowly, so that the latter may be found in greater or less numbers from the middle of May until the latter part of October.

The moths begin to emerge in the spring about the first of May, and shortly after begin ovipositing.

The eggs are laid in little masses of from 25 to 30 on the under surfaces of the leaves. They are oval, flattened, .5^{mm} in length, pale green, shading to a whitish margin, and overlap like the scales of a fish, but not so regularly. They are attached and protected by a varnish-like fluid extruded with them, which hardens upon exposure to the air. The larvæ hatch, simultaneously, in seven or eight days, and remain in company for a short time, gnawing the parenchyma in small spots from the under surface of the leaf on which they are hatched. They are at first about 2^{mm} in length, very slender, and of a pale translucent green color. They spin a slight web, and if the plant is shaken let themselves down by an invisible thread. After the first molt they separate, seldom more than two or three of a size being afterwards found upon the same leaf.

They retain the glassy whitish green color, occasionally varied with a tinge of pink, until the fourth age, after which they are seldom found upon the leaves in the daytime, as their more opaque and darker colors would render them conspicuous to their enemies.

Maturity is reached in from twenty to twenty-five days unless the food supply has been irregular, in which case they grow for an entire month or more. They spin considerable web to guide themselves back and forth or to suspend themselves if the foliage be shaken. This silk though very fine is remarkable for its strength. The full grown larva is 25^{mm} in length and between 3 and 4^{mm} in diameter, according as it is extended in crawling or somewhat contracted in repose. The form is slightly depressed and tapers toward either end. In some specimens it is of a pinkish or brownish gray, very indistinctly striped even on the sides. In others it becomes of an opaque olive green, with an irregular, ivory white stigmatal band, and finer interrupted dorsal and lateral stripes of the same color. The minute piliferous spots are black, surrounded with a whitish ring, hairs black. Head distinctly bilobed, pale brown with transverse bands of a slightly darker shade. The legs and prolegs are rather long and the latter are surrounded with a few stout bristles. The cocoon is formed upon the ground among the fallen leaves. It is of irregular shape, rather flat, and of very tough silk of a dingy brown color. The pupa is slender, elongate and smooth, of a bright, pale golden brown color. The imago appears in about two weeks in midsummer, the second brood hibernating in the pupa state.

Dr. Riley thinks the species undescribed, and if it should prove to be so will appropriately locate and characterize it.

The larvæ may be kept in check by careful spraying with any of the arsenical insecticides. I have not as yet experimented with any others.

Editorial Note.—The above paper by Miss Murtfeldt was read before the Entomological Club of the A. A. A. S., and is published by request in Insect Life. We have had for some time in our collection specimens of this interesting Pyralid obtained in 1879 at Columbus, Tex., when, during our sojourn there with Mr. E. A. Schwarz, the larvæ were found quite abundant on the Osage Orange, in one particular case defoliating the tree. The first imago issued July 19 of that year. We supplement Miss Murtfeldt's article by a brief characterization of the moth, which is an undescribed species, and which Prof. C. H. Fernald, to whom we submitted specimens, would place in the genus Loxostege Hübner. This genus, according to Hübner's characterization, is distinguished chiefly by the falcate form of the front wings. In general coloration and markings, and in the form of the wings, the species reminds one of a diminutive specimen of the common Cotton Worm Moth (*Aletia xylina*). The genus Loxostege is not recognized by Heinemann, but as the genera Eurycreon and Botys, to which the types of Loxostege have been referred, contain a large number of species, Prof. Fernald, who is monographing the family, doubt-

less finds good grounds for retaining Hübner's term. The figure of the cocoon which we have had prepared to illustrate this article represents a somewhat abnormal form. As a rule the cocoon is more or less hidden within the folds of the leaf. The insect is a southwestern form, and its sudden occurrence near St. Louis would indicate that it is spreading northward.—C. V. R.

Loxostege macluræ n. sp.—Average expanse, 23^{mm}. General color above, lustrous, pale-gray, argillaceous, with a more or less decided olivaceous tint, according to the specimen, the legs, venter, hair on thorax beneath, basal joint of palpi, borders of occipital tuft, and sometimes the basal joint of antennæ and base of tongue above, white. Eyes large, naked, varying from olive-green to dark-brown; occiput, narrow between the eyes, with a dense and evenly shorn tuft approaching in form a parallelogram; palpi, densely clothed, the terminal joint porrect; tongue, with the basal portion, clothed. Primaries with the dusky tranverse lines as follows: Basal line across basal one-fourth of wing beginning at the sub-costal vein, angulate basally to the median vein, then posteriorly to vein 1, and then almost straight across the wing to the inner border. Median line across the middle of the wing, also beginning, in a more or less distinct spot, at the sub-costal vein, and running irregularly with two more decided curves outward between the bases of vein 4 and vein 2, and with two curves inward from about vein 1 to the inner border. The posterior stripe starts at the costa, where it is most distinct, about the posterior fourth of the wing, and runs in a series of scallops nearly directly across the wing to vein 4, and then joins the median line about its middle. Costa somewhat darker than the general surface, the coloring intensifying to the falcate apex, which is more or less intensely black. Fringes white, with a black coincident inner border. Secondaries scarcely paler than the primaries, and with a faint lunulate dark line across outer third; this line obsolete in some specimens; fringes white or but very slightly darker, with coincident inner shade. Under surface more silvery than the upper surface, the primaries having but a faint discal spot and lunule and the merest trace of the posterior dark line; the costa and the terminal space are, however, generally paler than the rest of the wing: Secondaries with transverse line more distinct than on upper surface. Described from 10 specimens, reared from Texas and Missouri.

There is considerable variation in the dusky lines, which are (in two specimens) very distinct and continuous (especially the posterior one), but ordinarily they are more intense on the veins and subobsolete between them. In the ♂ the undersurfaces are more distinctly silvery than in the female, while in this last the dusky line on secondaries is most distinctly shown. The fringes sometimes show a double coincident dark shade and sometimes a distinct paler coincident inner line.

THE FOOD PLANTS OF SOME JAMAICAN COCCIDÆ.

By T. D. A. Cockerell, *Kingston, Jamaica.*

During the last few months I have been systematically examining various cultivated plants in order to ascertain what species of Coccidæ, if any, infested them. The result shows that in Kingston many species, especially trees and shrubs, suffer from the attacks of scale-insects, and also that the same scales not unfrequently occur on many different hosts. It is not supposed, of course, that the food plants here given are always or often the natural hosts of the various Coccidæ now found

on them, but for several reasons it is interesting to learn what takes place under cultivation as well as in a state of nature. From an economic point of view, especially, facts of this kind may be of importance, because it may well happen that a destructive scale is brought into a country on a plant of small value, whence spreading, it attacks other species which form the staple crops on which the welfare of the population depends.

Much of the material examined was collected by my assistant, Mr. F. Da Costa; in every case, when I did not obtain the material myself, the name of the collector is given.

(1) *Achras sapota* L. (Sapotaceæ).—In June Mrs. Swainson told me she had found *Vinsonia stellifera* Westw. on this species in Kingston; later, Dr. Plaxton sent some leaves, with many *V. stellifera* on their under sides.

(2) *Anacardium occidentale* L. (Terebinthaceæ).—A leaf picked in Kingston (Mrs. Swainson) in June had on its upper side a few *Aspidiotus articulatus*, Morg.; there were also on the leaf a few *Aspidiotus personatus*, Comst., a very young *Ceroplastes* (gray, with white center and fourteen white rays) and a very young pale greenish *Lecanium*.

(3) *Artocarpus incisa* L. f. (Urticaceæ).—On June 9 I found leaves of Bread fruit in Manchester Square, Kingston, with many *Aspid. articulatus* and *A. ficus* Riley on them; on one leaf the two species were crowded together in one or two places, leaving the rest of the leaf almost free. I found also some *A. personatus*.

(4) *Areca catechu* L. (Palmæ).—A young plant growing in a pot at Cavaliers, Pen., September, 1892, had on the upper side of its leaves many *Aspidiotus ficus* and several *A. aurantii* Mask.; also a few *Lecanium hemisphæricum* Targ. The presence of *A. aurantii* and the absence of *A. articulatus* is noteworthy. Mr. Coquillett has also found the Red Scale on palms (Bull. No. 26, Div. Ent., p. 15), and as these are often taken from one country to another in pots, the possibility of so increasing the range of *A. aurantii* should be considered.

(5) *Anthurium lanceolatum* Kth. (Aroidæ).—In Dr. Strachan's garden, in Kingston, I find the leaves infested with *Ceroplastes floridensis* Comst., *Parlatoria*, and *Lecanium*. The *Lecanium* is a dull greenish flat species like *hesperidum*, with (at least in juv.) the sides of the posterior cleft contiguous and the margin with short simple hairs; anal plates yellowish with brown tips; eyes black, very distinct, placed close to margin.

(6) *Brunfelsia americana*, Sw. (*Solanaceæ*).—Leaves gathered in the Parade Garden, Kingston, June, 1892 (Da Costa), had on their upper sides several *Aspidiotus articulatus*, and one juvenile *Ceroplastes*, apparently *floridensis*.

(7) *Cassia fistula*, L. (Leguminosæ).—Leaves from the Parade Garden, June (Da Costa), had on their upper sides plenty of *Aspidiotus articulatus*, also a few *A. personatus*, which seemed not to be thriving.

(8.) *Chrysophyllum cainito*, L. (Sapotaceæ).—In Manchester Square, Kingston, I found *Aspid. articulatus* on the upper sides of the leaves; afterwards (June 14), in Duke street, I found *A. articulatus*, *A. personatus*, and *Pulvinaria cupaniæ*, Ckll. MS.;* also, a few specimens of a small *Diaspis* or *Chionaspis*, which I did not study.

---

*Details of this species will be published later. It is very common on Akee (*Cupania edulis*, Camb.), in Kingston. The ♀, before they produce their egg sacs, are green, active, and resemble in shape the flat species of *Lecanium*. Length of ♀ with egg-sac about 5 mill. Antennæ 8-jointed; third much longest; fourth as long or a little longer than second; fifth a little shorter than fourth; sixth, seventh, eighth, subequal, eighth shortest of all, a little elongate; second, fifth, and sixth joints each with a long hair. Tibia about twice length of tarsus.

(9) *Chrysanthemum* (Compositæ).—In Dr. Strachan's garden in Kingston I found the ordinary cultivated species very badly infested by *Lecanium hemisphæricum*, and less severely by *Orthesia insignis*, Dougl.

(10) *Ficus* (Urticaceæ).—On a large *Ficus* tree in the yard of the Museum, *Ceroplastes floridensis* is common, with *Aspid. articulatus*, *A. ficus*, and *A. personatus*. *A. ficus* is on the under side of the leaves, but the other two species of the genus mainly on the upper.

(11) *Grewia rothii* (Tiliaceæ).—Leaves from the Parade Garden in June (Da Costa) had a few young *Ceroplastes floridensis* on their upper sides.

(12) *Ixora coccinea* (Rubiaceæ).—Leaves from the Parade Garden in June (Da Costa) had on their upper sides some very young *Ceroplastes*, apparently *floridensis*. *Ixora* sp. in Dr. Strachan's garden was badly attacked by *Lecanium hemisphæricum*.

(13) *Iambosa malaccensis* (L.) D. C. (Myrtaceæ).—In June Mrs. Swainson brought me leaves picked in Kingston, on the under sides of which were several *Vinsonia stellifera*, and some *Lecanium mangiferæ*, green.

(14) *Musa* (Musaceæ).—In August I found several *Aspid. articulatus* on a leaf in the garden of the Museum. A young banana in the Museum yard, recently planted, soon had on it an adult, or nearly adult, scale of *Ceroplastes floridensis*. It was doubtless blown as a larva from an overhanging *Ficus*. In September the same tree had on it also *A. articulatus*, *A. personatus*, and *A. ficus*, but the two latter species seemed not to thrive.

(15) *Meyenia alba* (Acanthaceæ).—A specimen from the Parade Garden, June (Da Costa), had on it a few *Lecanium oleæ* Bern.

(16) *Murraya* (Aurantiaceæ).—In June Mr. C. B. Taylor brought me a twig of this shrub, obtained in Kingston, with *Aspid. articulatus* and *Mytilaspis citricola* (Pack.). Comstock remarks (1883, Report, p. 117) that *M. citricola* is only found on *Citrus* trees, and now that an exception to this statement is found it is interesting to note that the plant is of the same natural order.

(17) *Mangifera indica*, L. (Terebinthaceæ.)—(*a*) In June Mrs. Swainson brought me leaves of Mango picked in Kingston, on which were several *Vinsonia stellifera*, some *Aspidiotus personatus*, and two small scales of *A. articulatus*.

(*b*) In June I found in Manchester Square, Kingston, leaves of Mango on which were *Lecanium oleæ*, *L. mangiferæ*, *Ceroplastes* (apparently *floridensis*), *Vinsonia*, *Aspidiotus personatus*, and *Aspidiotus* n. sp.

(*c*) In June Miss Helen Kilburn sent me two green mangoes, from Kingston, much infested by *Dactylopius longifilis*, Comst. (♀'s and young); there were also two specimens of a flat *Aspidiotus*, each making a pale patch on the fruit.

(18) *Merium oleander* (Apocynaceæ).—Leaves of oleander received from Mr. Rouse in June had on them *Aspid. ficus*, *A. articulatus*, and *A. personatus*.

(19) *Olea hispanica* (Oleaceæ).—On leaves from the Parade Garden, June (Da Costa), were very many *Aspid. personatus* and a few *A. articulatus*.

(20) *Persea persea* (L.) =*gratissima*, G. (Laurineæ).—In June Mrs. Swainson brought me a leaf picked in Kingston on which were many *Aspid. personatus*, and one or two *A. articulatus*.

(21) *Punica granatum* L. (Lythraceæ).—A plant in garden of Museum has *Aleurodes* sp. on the under sides of the leaves and above is infested by *Aspidiotus personatus*, *A. articulatus*, and *A.* sp. (scale white, circular or nearly so, exuviæ covered, orange brown, first skin nipple-like and shiny; ♀ plump, rounded, orange). There are also a few examples of a small *Chionaspis*, probably *C. minor* Mask.

(22) *Portlandia grandiflora*, L. (Rubiaceæ).—Leaves from the Parade Garden, in June (Da Costa), had on their upper sides specimens of *Aspidiotus articulatus*.

(23) *Vitis vinifera*, L. (Ampelideæ).—In September my wife found a specimen of *Lecanium oleæ* on a black grape.

THE MAXILLARY TENTACLES OF PRONUBA.*

By JOHN B. SMITH, Sc. D., *New Brunswick, N. J.*

In his excellent studies on the genus Pronuba Dr. C. V. Riley has called special attention to the peculiarities of the mouth structure, and particularly to the development of a so-called "maxillary tentacle." The figures given of this structure in the various species are so excellent that they at once aroused a suspicion in my mind that, while they were really special developments in one sense of the term, so far as we now know unique in Lepidoptera, yet that there were similar or homologous structures elsewhere, in other orders; that is to say, there is really no new organ or process, only a mere adaptation or development of a known maxillary sclerite, which is paralleled by more or less similar developments or adaptations of the same sclerite in other groups. To the courtesy of Dr. Riley I owe a supply of alcoholic specimens of *Pronuba yuccasella* for examination, and from a careful study of these I have concluded that the so-called "tentacle" is really an extension of the palpifer or palpus bearer. Of all the Lepidoptera known to me, Pronuba has the maxillary sclerites best developed. Dr. Riley has called attention to the fact that the two halves of the spiral tongue are not united, as is usual in the higher Lepidoptera, to form a a tube, and I find that when the two maxillæ are dissected off the structure bears a remarkable resemblance to that found in the Coleopterous genus Nemognatha, and while the lacinia is wanting, some of the other sclerites are even better marked. A comparison of the figures of Nemognatha and Pronuba male will at once emphasize this similarity.

In the male Pronuba the "maxillary tentacle" is not developed; but if we examine the large sclerite at the base of the palpus, which is a palpifer without doubt, we see, evidently, the structure whose specialization forms the "tentacle." This special development of the palpifer is not unique in Pronuba, but is of common occurrence in the piercing Diptera, Erax offering an excellent example. In a paper published by me in the Trans. Am. Ent. Soc., XVII, 1890, I showed the modifications of this structure in the Diptera; but I was unable at that time to decide whether I had to do with a palpifer or with a stipes, because specialization and division of parts was carried to such an extent that the connection between the original sclerites was obscured. In the Hemiptera as well, the same sclerite is developed into a piercing organ, although the maxillary palpi themselves are rudimentary.

It may be objected that these structures of the Diptera and Hemiptera are rigid, chitinous processes, without tactile functions, while in Pronuba the process is flexible and set with numerous tactile or specialized spinules. This kind of change, however, is not unusual in insects, and precisely the same difference appears between the rigid chitinous ligula

---

*Read before Section F of the A. A. A. S., at the Rochester meeting, August 18, 1892.

of the piercing flies and the flexible, sensitive ligula of the bees. In the structure of the galea, yet more marked changes occur, the difference between the palpiform organs in some Coleoptera, the united rigid beak-like form in the Hemiptera, the flexible coil-like structure in the Lepidoptera, and the peculiar tongue-like organ in some Diptera being vastly greater than anything seen in the palpifer. In the Panorpidæ of the order Neuroptera we have, however, a development of the palpifer, which is not rigid, but is membranous, though not flexible, and which is set with hair which, in part at least, is tactile in function.

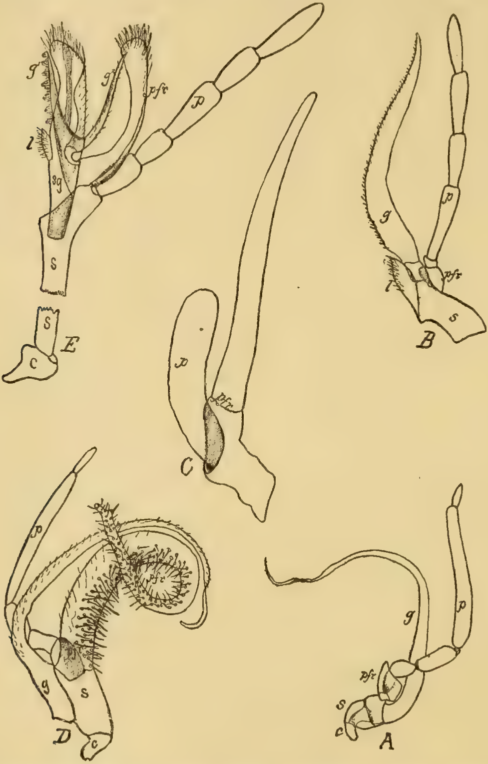


FIG. 12.—*A*, Maxilla of *Pronuba* ♂ *c*, cardo; *s*, stipes; *pfr*, palpifer; *p*, palpus; *g*, galea. *B*, Maxilla of *Nemognatha*, *s*, stipes; *pfr*, palpifer: *p*, palpus; *g*, galea; *l*, lacinia. *C*, *p*, palpus; *pfr*, palpifer of Erax. *D*, Maxilla of *Pronuba* ♀ *c*, cardo; *s*, stipes; *pfr*, palpifer; *p*, palpus; *g*, galea. *E*, Maxilla of *Bittacus*, *c*, cardo; *s*, stipes; *pfr*, palpifer; *p*, palpus; g^1, galea, first joint; g^2, galea, second joint; *sg*, sub-galea; *l*, lacinia. (From drawings by John B. Smith.)

In this same family of Panorpidæ we have, by the by, a most remarkable example of the elongation of the mouth parts. The lacinia is small, yet obvious; the subgalea is elongated from each side, forming

lobes; each joint of the galea is elongated between these lobes and, finally, the palpifer is a flattened, elongated, partly membranous process, from the base of which the palpus arises. The figure of the Bittacus maxilla shows only incompletely the really remarkable structure of this family. My studies on it are yet too incomplete to make generalization safe, but I believe that they will afford a most valuable clew to the line in which certain mouth structures have developed.

The conclusion after an examination of these structures is irresistible; the flexible process in Pronuba is an extension of the palpifer, homologous with the rigid piercing structure in the Hemiptera and piercing Diptera, and with the more membranous structure in the Panorpidæ. It is a special development only in the sense that it is adapted for a special duty, and in the same sense that the ligula in Tabanus and in Apis are each special developments for the advantage of these insects.

THE POTATO-TUBER MOTH.

(*Lita solanella* Boisd.)

By R. ALLAN WIGHT, *Paeroa, N. Z.*

Mr. Koebele in his "Report of a Trip to Australia, to investigate the Natural Enemies of the Fluted Scale" (p. 25) writes: "The small Tineid, so destructive to potatoes in California, and no doubt already distributed over the most of the Western States, has been known in New Zealand for years, and it is doing the same mischief all over Australia, where it originated. In conversation with a merchant from Denver, Colo., recently, he said that a year ago he received three cart loads of California potatoes infested with these worms to such a degree that they could not be sold." As far as the New Zealand pest of the potato goes, it may very probably be native to Australia, where it has been known to exist for a great many years, but there can be no doubt that it is also native in New Zealand. There is in New Zealand a plant which grows in very watery swamps and gullies where water habitually lies. This plant is a species of flag, resembling what is called the "Coofers Flag." It grows to a height of some eight or nine feet, and always on the richest soil. The natives call it "Raufo" and use it extensively for lining their houses, and a great variety of other purposes. Its botanical name is *Typha angustifolia*, and it has a head very like that of the bulrush, only larger, being about eight inches long. This head, when ripe, bursts out into a fine downy material, and makes a bed as good as feathers, and even softer. The early settlers were very fond of gathering this substance to make their beds of, but there was one drawback in its being infested with disgusting maggots, and the down had to be baked in order to get rid of them. It is now nearly

forty years ago that the writer's attention was requested to these maggots, and they proved to be the larvæ of the small Tineid moth, *Lita solanella*. The natives have a knowledge of these larvæ being in the Raufo ever since they remember. It was not until about 1862 that these moths were heard of attacking the potato. About that time their ravages became so serious as very materially to affect the value of the crop and cause great loss to the farmers, and also to the natives. The general impression has always been that the abnormal habit was taught by the Europeans using the *angustifolia* as thatch for their potato houses. There is another and equally probable cause, that in older times the natives lived more on dry ground, on hills, and scoria land, and grew their crops there, but of later years both natives and Europeans have grown potatoes on land intersected by wet gullies, where the plant abounds. Be this as it may, there seems but little doubt that the insect is a native of New Zealand. The moth attacks the potato by laying its eggs on the stem, near the bottom. This is done just as they have died down and are ripe enough to harvest. The larvæ on being hatched enter the ground and attack the tubers, the outer portions of which they run burrows in, so that they become unfit for any purpose. Any potatoes left exposed in the field are attacked, and the attack goes on during the harvest and after the potatoes are housed. The native cure is to place live shellfish on the top of their potatoes in the houses, and they say that the unpleasant odor drives away the moth, but the truth is more likely that it hides the true nature of the contents of the house from the insect. The cure which the writer has advised, and which has always been attended with a good deal of success, is to harrow the potato stalks up in heaps and burn them before digging the roots, having previously planted full depth and molded very well up. This does not bring the tubers to the surface, and it facilitates the harvest, but care should be taken to keep the harrows just clear of the digging, and to keep the potatoes well and constantly covered during the harvest, and when they are carted to remove them to a place distant from the field, and also from the Angustifolia. As soon as the stalks die down the crop should be well rolled. Probably the use of Paris green might be attended with benefit, as the larvæ are in no hurry to reach the tubers. This is the only case in which the sparrow is of real benefit. It catches so many of these moths as to make a most material difference in their numbers, and in some instances the pest has been cleared, seemingly, altogether. The sparrow, however, gets more credit than he deserves. The great reduction—in fact, in some districts the disappearance—of the Army Caterpillars that used to destroy grain crops is owing to a wonderful increase of two species of well-known Ichneumonid flies that prey upon the larvæ of Noctuid moths, and not to the exertions of the sparrow.

FOOD-PLANTS OF NORTH AMERICAN SPECIES OF BRUCHUS.

FROM OUR OWN RECORDS.

Bruchus pisi Linn.—Frequently bred from peas.

Bruchus rufimanus Boh.—Bred from pea pods imported from Switzerland (Dr. G. H. Horn, Trans. Amer. Ent. Soc., vol. IV No. 1873, p. 313). Also bred from peas distributed by the U. S. Department of Agriculture in 1890.

Bruchus chinensis Linn.—(=*scutellaris*, Fabr., Gyll.).—Bred from beans at the New Orleans Exposition, July, 1885; also found infesting Chinese beans in the Seed Division of the U. S. Department of Agriculture.

Bruchus quadrimaculatus Fabr.—Infesting "Black-eyed table beans" from Texas at the Atlanta Cotton Exhibition; also bred from cow peas (*Dolichos* sp.) from Texas.

Bruchus discoideus Say.—Infests seeds of *Ipomea* (Riley, Third Missouri Report, 1871, p. 45).

Bruchus ulkei Horn.—The single specimen in our collection is without locality label, but bears this inscription: "Feeds on broad-podded Palo berde, Chelly." Palo berde is the popular name for Parkinsonia.

Bruchus bivulneratus Horn.—Bred from seeds of *Cassia marilandica* at St. Louis, Mo., January, Riley's notes, 1876.

Bruchus cruentatus Horn.—A specimen from the Riley collection is labeled, "In fruit of Parkinsonia, Arizona. Collected by Dr. Pringle. Sent by L. H. Hosford, Charlotte, Vt."

Bruchus pruininus Horn.—A specimen from the Riley collection is labeled, "In seeds of *Olneya tosata*, Arizona. A. S. Fuller, 1874." The name of the plant is misspelled on the label.

Bruchus prosopis Lec.—Bred from pods of *Prosopis juliflora*, Death Valley and Panamint Valley, Cal., April, 1889.

Bruchus protractus Horn.—Obtained with the preceding from the same plants and the same localities.

Bruchus n. sp.—Bred from pods of *Prosopis pubescens*, at San Diego, Cal., April 11, 1889.

Bruchus alboscutellatus Horn.—Bred from seeds of *Ludwigia alternifolia*, at Washington, D. C.

Bruchus obtectus Say.—Frequently bred from cultivated beans.

Bruchus fraterculus Horn.—Infests the seeds of *Hedysarum boreale*, at American Fork, Utah. (Schwarz.)

Bruchus amicus Horn.—Lives in the seed of *Parkinsonia torreyana* and *P. microphylla*, in Arizona; specimens sent by L. H. Hosford, Charlotte, Vt., January 9, 1882.

Bruchus hibisci Ol.—Bred from seed of *Hibiscus moscheutos*, at Bluffton, S. C., and Washington, D. C.; also from seed of *H.* sp. (*militaris?*), at St. Louis, Mo.

Bruchus schrankiæ Horn.—One specimen, bred by us at St. Louis, Mo.,

from seeds of *Schrankia uncinata* (Dr. G. H. Horn—Trans. Amer. Ent. Soc., vol. IV, 1873, p. 340).

Bruchus exiguus Horn.—Specimens from the Riley collection bred from seeds of *Amorpha fruticosa* by A. H. Mundt, Fairbury, Ill.; also bred from the same plant at Washington, D. C.

Bruchus sp.—Larva in seeds of *Phaseolus pauciflorus*, at St. Louis, Mo., in September. The imago was not reared.

Bruchus sp.—In seeds of Loco Weed, at Fort Collins, Colo. The larva only has been observed.

Bruchus sp.—The eggs of what is evidently a Bruchus occur on the pods of *Acacia filicina* in the collection from southern Arizona.

RECORDED ELSEWHERE.

Bruchus discoideus Say.—"In seeds of *Ipomœa leptophylla*."—F. H. Snow (Trans. Kans. Ac. Sc., vol. v, 1877, p. 18).

Bruchus aureolus Horn (smaller form).—"Occurs in Owen's Valley (Cal.) on the flowers of *Astragalus*."—Dr. G. H. Horn (Trans. Amer. Ent. Soc., vol. IV, 1873, p. 340).

Bruchus pruininus Horn.—"This species is found on the ironwood tree of Arizona."—Dr. G. H. Horn (loc. cit., p. 528).—This plant is, in all probability, *Olneya tesota*.

Bruchus desertorum Lec.—" Found in the same plants with *B. uniformis* and *prosopis*."—Dr. J. L. Leconte (Proc. Ac. Nat. Sc. Phil., vol. x, 1858, p. 78).—Occurs in the seed of the Screw Bean, *Strombocarpus pubescens*, in Arizona."—Dr. G. H. Horn (Trans. Amer. Ent. Soc., vol. IV, 1873, p. 329).

Bruchus uniformis Lec.—"Abundant in the pods of *Prosopis* and *Strombocarpus*, Colorado Desert."—Dr. J. L. Leconte (Proc. Ac. Nat. Sc. Phil., vol. x, 1858, p. 77).

Bruchus prosopis Lec.—"Found with *B. uniformis*."—Dr. J. L. Leconte (loc. cit., p. 78).

NOTE.—Of the remaining North American Bruchidæ, *Caryoborus arthriticus* breeds in the fruit of palmetto trees (genus Sabal) and *Spermophagus robiniæ* is well known to infest the seeds of *Gleditschia triacanthos*.

The food-plants of a few Mexican species of Bruchus may also be recorded here. The species were all found at the Department of Agriculture in seeds collected by Dr. Edward Palmer in northern Mexico.

Bruchus longicollis Fahr., in seeds of *Canavalbia* n. sp.

Bruchus compactus Sharp, ? in seeds of *Ipomœa* sp.

Bruchus lucosomus Sharp., in seeds of *Ipomœa* sp.

Bruchus desertorum Lec, in seeds of plant 1108 (Palmer).

Bruchus (No. 4324) in seeds of plant 305 (Palmer).

THE STRAWBERRY WEEVIL.

(*Anthonomus signatus* Say.)

By F. H. Chittenden.

In the Annual Report of the Entomologist for 1885 (pp. 276–282) an account is given of this little strawberry pest which includes a summary of its past history, a report of the injuries and habits of the insect as observed that year on Staten Island, and a full description of the adult and its varieties. Illustrations were also furnished of the imago enlarged and of a group of the same feeding on the strawberry blossoms. These figures are reproduced herewith. (Figs. 13 and 15.)

Upon the appearance of this insect in the spring of 1892, near Washington, I was instructed by Dr. Riley to make a careful investigation of the life-history of the species and to prepare a complete account of the insect as a crop pest. This paper is the result of this investigation, in the course of which I have had access to Dr. Riley's notes and those of the Division, and have been assisted by Dr. Riley's advice.

PAST HISTORY.

This insect was first noticed as injurious to the Strawberry in 1871, and an account of its injuries at Silver Hill, Md., was published by Townend Glover, in the Monthly Report of this Department for November-December, 1871, and in the Annual Report of the same year. In 1873 it was found by Prof. Riley injuring strawberries in the vicinity of St. Louis, Mo. In 1883 Prof. A. J. Cook published a short account of its depredations in Phœnix, Mich., and in 1888 mentions it as injurious in Pontiac, Mich. In 1884 and 1885 it was injurious on Staten Island. During the year 1887 serious injuries were reported from Cowansville, Province of Quebec, Canada, mention being made of the fact by Mr. James Fletcher in his report as Entomologist and Botanist of the Experimental Farms of Canada for that year.

No subsequent mention of injuries so far as can be learned was made, and its life-history remained unknown until the publication of an article by Mr. Fletcher in his report for 1890 (pp. 173–175). In February of the previous year Mr. W. A. Hale wrote Mr. Fletcher, giving the first true account of the insect's breeding habits. He had for several years suffered from its ravages, and had succeeded in ascertaining that it attacked all staminate varieties, and that the egg is deposited in the unopened flower-buds in which the insect undergoes all its transformations. Mr. Hale also stated that the insect was noticed at Hamilton, Canada, in 1886.

Fig. 13.—*Anthonomus signatus:* Spray of strawberry, showing beetles at work—natural size (after Riley).

In June of 1891 specimens were received at the Department from Dr. George Dimmock of Canobie Lake, N. H., with the statement that they were proving quite destructive to the buds of blackberries, especially the Wachusett variety. (INSECT LIFE, vol. IV, p. 76.)

THIS YEAR'S INVESTIGATIONS.

During the past season the Division was notified that this insect was making its appearance in numbers in several localities about Washington, notably in Anne Arundel, Caroline, Baltimore, and Prince George's counties in Maryland, and in Fairfax and Alexandria counties, Virginia, and several large strawberry-growers were reported as suffering severe loss.

Mr. H. E. Van Deman, Chief of the Division of Pomology, made extensive trips early in the season through the fruit-growing regions of Maryland and Virginia, and reported that the strawberry crop in the districts visited was about two-thirds short. This shortage, though attributed to hail, of which there were two or three severe storms during the month of May, was probably due largely to the Strawberry Weevil. One such case of reported damage by hail actually proved on investigation to be due to the ravages of this species.

On account of the small size of the insect and its peculiar manner of working it often escapes notice and the fruit-grower, unless forewarned, seldom discovers his loss until berry-picking time approaches, and even then the author of the mischief is not suspected; hail, frost, and anything but the true reason being ascribed as cause for the crop's failure.

Injury to "Sharpless" and other full-flowered varieties has been very general in this region, probably over a much wider area both this year and in past seasons than will ever be known.

Several trips were made to infested localities in the immediate neighborhood, and although work was begun too late in the season for the investigation of certain points in the life-history of the insect that it is desirable to know, a number of new facts of interest were ascertained which will aid materially in our efforts to obtain a remedy or preventive against future attacks.

Injuries were not reported until considerable damage had been done and I was not able to begin investigations until May 17, when in company with Mr. A. B. Cordley, of this Division, I visited the farms of Messrs. Sprankle and Phillips, at Falls Church, Va.

The insects had not been discovered on Mr. Sprankle's place until the 1st of May and at the time of our first visit were rapidly disappearing. The work of this insect had been noticed the preceding year, 1891, but no perceptible damage had been done. Mr. Sprankle's field is about four acres in extent and composed of staminate berries, principally of the "Sharpless" and "Kentucky" varieties. It was estimated that at least 75 per cent of this crop was lost this year. These were all first season vines.

The neighboring patches of the Messrs. Phillips also showed considerable damage. A patch composed of "Crescents," a pistillate or imperfect-bearing variety, with occasional rows of "Sharpless" plants interspersed for fertilization, was damaged about 15 per cent. A second bed composed of staminate plants was about half destroyed, and a third bed of "Wilsons," a full-flowered or perfect variety like the "Sharpless," was damaged to nearly the same extent.

The insects were also found at work at Carlin Springs, two miles east of Falls Church.

Mr. G. W. Donaldson, of "Dixie Landing," Va., a few miles from Washington, reported injury to his berries, but when his place was visited, June 6, the beetles of both broods had practically disappeared from the strawberry beds as none were to be seen on the few plants still flowering at this time. His crop of "Sharpless" berries was nearly all destroyed, "Wilsons" damaged about one-third, while no injury was perceptible on "Mt. Vernon" and "Crescent" varieties. The strawberries on the adjoining farm of W. C. Donaldson, had been similarly attacked. No damage had been noticed the previous year.

Since this paper was prepared for the press Mr. M. H. Beckwith has published a short article on this species in Bulletin XVIII of the Delaware Experiment Station, in which he reports injuries to strawberries in the vicinity of the towns of Dover, Hartley, Camden, Wyoming, Smyrna, and Clayton, Delaware. Specimens were kept under observation by him and the adults bred, but no new points in the insect's life-history were developed. Mr. Beckwith's statement that the beetles were found on young peach trees in September is significant, and I would not be surprised to learn that the insect breeds in the buds of peaches and other Rosaceæ, whose blossoms furnish the requisite conditions for its development. Mr. Beckwith states that the reared beetles mated but no eggs were found, duplicating our own observations, with the exception that although the insects apparently paired, actual copulation did not take place in our breeding cages. As to his surmise that there are probably two and possibly three broods during the season the investigations this year indicate that the insect is normally single brooded. The occurrence of this species later than July has also been noted by Dr. John Hamilton (*Canadian Entomologist*, vol. XXIV, p. 41), who states that specimens may be found throughout the season. These late occurrences are probably quite rare and do not necessarily point to a second annual generation.

Other Cases of local Damage.—From information kindly communicated by Mr. Sprankle concerning local injuries it would seem that the ravages of this strawberry pest have been widespread through Alexandria and Fairfax counties. A few facts with regard to some of the many cases reported by him are here repeated.

Mr. E. C. Walker had noticed the insect and its work in his strawberry beds for four or five years past, but had not observed any injury

of moment until 1890, when he lost about a quarter of his crop. On the year following no serious damage was apparent, but in the present year his crop has been all but destroyed. Mr. W. A. Taylor, of the Division of Pomology, visited Mr. Walker's place June 1, and at my suggestion kindly made a careful investigation of the injured vines. He places 85 per cent as a conservative estimate on the injury to the "Sharpless" variety. In some "trusses" only a single berry to eleven dead buds were counted. The "Charles Downing" variety on these premises was damaged about 25 per cent and the "Crescent" about 15 per cent.

Mr. Alfred B. Clark reported severe injury to his "Sharpless" berries, and "Crescents" not materially damaged. Mr. Clark further stated that the "Wilson" strawberries of a neighbor of his were nearly as badly damaged as "Sharpless." He had noticed the work of this insect in former years and once or twice it had been as injurious as during the present season.

A Mr. Jacobs reported his "Sharpless" so badly cut that he had about decided to plow them up.

A family by the name of Kirby had suffered the usual amount of damage to "Sharpless" berries; "Kentucky" variety injured in less degree, and other varieties not much troubled.

A Mr. Crimmins stated that the weevil had "mowed" his "Sharpless" berries, but his "Crescents" had not been injured.

Mr. Barnum, an extensive grower of small fruits, near Lewinville, also complained that the weevil had taken the largest part of his "Sharpless" berries.

From Mr. L. S. Abbott I also obtained some facts regarding damage in Fairfax County. Mr. W. F. Birch reported his crop of "Sharpless" berries a failure, while "Manchester" and "Crescent" bore abundant crops. Mr. Frank Birch claimed to have lost his entire crop of "Sharpless." His vines bore absolutely nothing.

Mr. H. T. Curtiss, of Ridgely, Carolina County, Md., in correspondence with the Division of Pomology, stated that his berries were being destroyed by an insect called the Strawberry Curculio. These insects were particularly severe upon "Monmouth," "Pineapple," "Jessie," and "Gandy's Prize," all staminate or perfect-flowered varieties. He thinks the "Belmont" more free from attack than any other variety.

WORK OF THE INSECT.

Appearance of infested Fields.—The four-acre patch of Mr. Sprankle presented a peculiar appearance when visited during the middle of May. Instead of a field blooming with strawberry blossoms only from one to three flowers, rarely more, and a similar number of ripening berries were to be seen on a single plant, but many new buds were developing unharmed on account of the disappearance of a great proportion of the insects. Of the injured buds at this time about half

were dried or drooping on the flower-stalks, while the other half had fallen, the severed stem showing where the insect had been at work. Two of these injured sprays are shown in the accompanying figure.

A similar appearance was presented in other badly damaged fields. Only in very rare cases was every bud on a plant killed.

How Damage is done.—The principal damage is done by the adult beetles puncturing the pedicel or flower-stem a short distance below the flower-buds. The order of proceeding has not been ascertained, but the egg is deposited in the fully-formed bud which is attacked usually just before blooming, and the stem is injured in such manner as to kill the plant above the point of attack, causing the bud to droop, turn brown, and die, afterwards in most cases to drop to the ground. The severed ends of the stems present the appearance of having been girdled. The

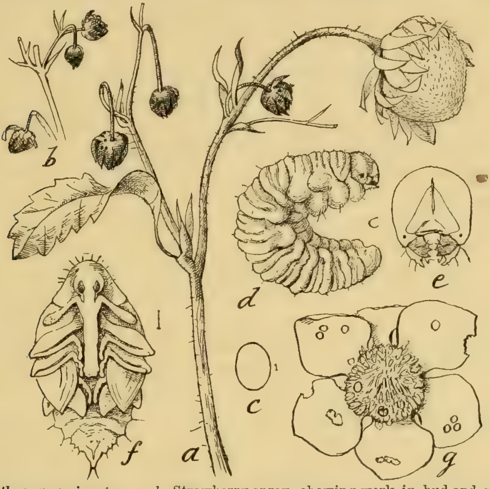


FIG. 14.—*Anthonomus signatus:* *a*, *b*, Strawberry spray, showing work in bud and stem—natural size; *c*, outline of egg; *d*, larva; *e*, head of larva—much enlarged; *f*, pupa; *g*, open bud, showing location of egg on left and punctures made by snout of beetle on petals. (Original.)

buds are not severed outright, as far as can be ascertained, but remain for a longer or shorter time on the vines before falling. Neither do they always contain larvæ, since some buds, particularly those that were gathered late in the season, and which had been attacked and killed, did not show when opened any evidence of having been perforated for any other purpose than for food.

The flower-stems are cut at varying distances from the bud. An eighth of an inch might be given as the average, but specimens are commonly found that are punctured at both longer and shorter distances from the bud, from a sixteenth or shorter, to one and three-quarters of an inch and even longer.

The object obtained by the puncture of the flower-stem is two-fold. First, the development of the bud is arrested, the outer envelopes of sepals and petals turn hard and dry, remain folded, and thus retain the pollen and the eggs or growing larvæ of the insect. If the flowers were permitted to develop, the pollen, which furnishes the principal food supply of the larvæ, would be lost and the larvæ would, therefore, in any event die of starvation if indeed they did not drop out when the flower opened or were not crowded out by the growing berry. Berries were seen that showed scars on one side as if development had been stopped at this point either by the punctures of the beetle or by the work of the larvæ which had hatched and failed to mature. It is not to be believed that a single minute puncture made in the bud, such as so small an insect is capable of making, could possibly kill the bud, but a slight injury is sufficient to kill the narrow and delicate stem above the point of attack. The second result obtained is that the bud in most instances drops off in a few days to the ground, where it is kept more or less moist. If allowed to remain on the stem in ordinarily dry weather the injured buds would eventually become so dry as to prevent the development of the insect within.

To test this matter a quantity of injured strawberry buds with their contained larvæ were kept in the Insectary under different conditions or degrees of moisture. A number of the insects failed to reach maturity in such buds as had become extremely dry. A second lot, gathered from the vines late in the season, and which had probably remained exposed to the sun for a considerable time, did not yield as many of the insects as those which were taken from the ground at the same time. A third lot was kept constantly moistened and became covered with mold, but the insects thrived still better under these conditions and not an instance was observed where they or their parasites died from exposure to this excessive moisture or mold.

It has been noticed that in cases where strawberry buds escape the destroyer and throw out blossoms they usually remain thereafter unharmed, but larvæ have been found in full-blown but deadened flowers the pedicels of which showed no signs of puncture, and beetles have matured in flowers that had been injured, but not in such degree as to prevent them from closing up and retaining the pollen.

Nearly all of the injured buds gathered early in the season and which bore external evidence of having been attacked at the customary time, *i. e.*, just before blossoming, contained larvæ, a single individual to the bud, and a large number were opened before more than one was found. In the few buds that harbored two larvæ, they occupied opposite sides and there was ample room and food for both.

Work on Blackberry.—A blackberry patch at Falls Church, of the variety known as "Early Harvest," was visited June 3, and although the bushes were covered with white blossoms betokening under normal conditions a rich crop of berries, it was soon seen that the insect had been at work, but not in the same uniform manner as on strawberry,

some plants being noticeably more injured than others. An estimate of the total damage done to the patch is about 20 per cent. Badly damaged sprays selected at random showed an average of five or six injured buds to each flower cluster. On one large spray over two-thirds had been killed.

From the examination of material collected at this date it was ascertained that the work of the Strawberry Weevil on Blackberry does not differ materially either in appearance or in ultimate injury from that on the Strawberry. Some differences, however, were noted. It will be remembered that nearly all injured strawberry buds taken from the fields May 17 contained larvæ or eggs. The punctures were in nearly every instance plainly seen both on the buds and on the stem beneath. The latter were in many cases nearly cut through. On the blackberry only a small proportion of the blighted buds showed the punctures plainly, and some, although cut at the stem, did not reveal any punctures whatever on the calyx, or on the corolla when the bud was opened. In other cases where no punctures were visible on the outer surface of the calyx an examination of the corolla within showed punctures in several places. Sometimes the wounded spot in the calyx had healed up or grown over so as to be nearly invisible, and in other cases the punctures had been made between the sepals or leaves of the calyx. Only eggs and freshly hatched larvæ were found at this date and a considerable percentage (20 per cent) of the injured buds were entirely empty.

Certain Varieties more affected than Others.—It has always been noticed when opportunity has offered for comparison that the varieties of strawberry, termed variously perfect-bearing, staminate, bisexual or hermaphrodite are more severely injured than the pistillates or imperfect bearers, but no cause for this difference has been assigned. It has also been observed that "Sharpless" plants were much more badly damaged than other staminate varieties. Observations made this season will, I think, explain the reasons. These observations indicate that the injury to strawberry by this insect is in direct proportion (1) to the quantity of pollen produced, and (2) to the amount of exposure of the growing buds and the flowers to the sun.

That pollen constitutes by far the larger proportion of the food of the adults is, I believe, beyond question. It not only furnishes a large portion of the food of the growing larva but is without doubt essential to its development. Those varieties whose flowers produce the greatest quantity of pollen naturally serve to attract the most beetles, hence the more pollen produced the greater the injury. This explains why the "Sharpless" and other staminates are more severely attacked than pistillates like the "Crescents," but I am indebted to Mr. W. A. Taylor for an explanation of why "Sharpless" berries should be more affected than other staminate varieties.

On the farm of Mr. Walker two varieties, "Sharpless" and "Charles Downing," were growing, affording an excellent opportunity for comparison. These varieties produce a similar amount of pollen, but in the

latter the buds and flowers are better protected from the rays of the sun and are hence not so much frequented by the beetles, but as corroborative testimony of the effect of shade a row of "Sharpless" berries on this place which was encroached upon and shaded on the west side by a field of rye, was found to bear double the number of berries of those in other parts of the field that were not shaded.

It will be noticed in the report of local damage that "Crescents" in some fields were damaged 15 per cent while in others they were not apparently harmed. An explanation of this may be found in the fact that this variety varies, some lots producing much more pollen than others, and are injured in proportion.

Raspberries of the "Black Cap" varieties appear to be for some reason strangely exempt from the attack of the Strawberry Weevil, but whether or not the Red Raspberry enjoys the same immunity has not been ascertained. On Mr. Sprankle's place at Falls Church a patch of "Black Caps" which is located between the infested strawberry bed and blackberry bushes previously referred to, was repeatedly examined for traces of the attack of this insect, but most careful search failed to show any signs of injury, and no beetles were found even with the aid of a beating net.

Wild Food-plants.—Cultivated strawberry has now become the favorite food-plant of this species of Anthonomus. From finding cultivated blackberries infested one would naturally expect to find them on the wild plants and such has proved to be the case. Wild blackberries bloomed this season throughout the month of June, and on the 3d of this month at Falls Church were in full bloom and fairly well peopled with beetles, cultivated plants of the immediate vicinity being out of bloom and deserted.

The wild plant, *Rubus villosus*, is probably the natural food-plant of this species. Dewberries, *Rubus canadensis*, were examined and a number of injured buds were found, but on closer inspection proved to contain only Dipterous larvæ. It is still somewhat doubtful whether this species is attacked or not, but in any event not to a great extent.

Wild strawberries and the little yellow-flowered Cinquefoil, *Potentilla canadensis*, were growing at Falls Church, and these and several other berry-producing plants were carefully examined. Wild strawberry plants were quite scarce here and no berries at all were to be found, the buds having nearly all dropped off. Larvæ were found in the few that were still attached to the vines. The Potentilla was in full bloom June 3, beetles were found on the flowers, and larvæ less than half grown were taken from injured buds.

The beetles found upon or bred from Wild Strawberry are necessarily smaller on account of the extremely limited food supply. They are also much darker than the average and have all the appearance of a distinct species. The individuals captured on Potentilla have the same size and appearance.

Several varieties of blueberries and huckleberries (*Vaccinium* spp. and *Gaylussacia resinosa*) were found to have been attacked by some insect, but the nature of the work in the buds or ripening berries plainly showed that it was not this Anthonomus. I believe it impossible for this species to breed in these plants. The adult beetles also frequent a number of flowers besides those already mentioned, among them the Flowering Dogwood (*Cornus florida*) in early May, and Wild Bergamot or Horse-mint (*Monarda fistulosa*) late in June. The beetles were swarming on the last-mentioned plant at this date, but after the first week of July they are seldom met with, and it is presumed that they begin to hibernate at this time, as they have not been traced further.

In past years Dr. Riley found this species in Missouri in July on Grape blossoms and Yucca flowers, and Dr. Hamilton has taken it abundantly on Tilia and Rhus in Pennsylvania (*Can. Ent.*, vol. XXIV, p. 41).

Differences due to Food-plants.—A marked difference is manifest between the immature stages found on Strawberry and Blackberry, and still further variations might be found to exist in individuals living upon other plants. No differences have been observed among the very young larvæ that could be attributed to difference in food-habit, but in more mature larvæ and in the pupæ a marked dissimilarity in color is apparent. Specimens taken from strawberry buds are of a decided yellow, while those from blackberry are nearly white.

In the adult beetles bred this year those which first matured average larger, and lighter and brighter colored, and are more distinctly marked on the elytra than such as were bred later.* The differences in adult individuals due to different food-plants have already been mentioned.

The Species doing the Damage.—It will be noticed by comparing the heading of the present article with that used by Dr. Riley in the 1885 Report that the species is now referred to as *Anthonomus signatus*, while in the earlier article it was called *musculus*. This apparent discrepancy cannot better be accounted for than by quoting from the original article (p. 280): "* * * This strawberry pest was referred by Mr. Glover to *Anthonomus signatus* Say, and a number of our own specimens agree so closely with Say's original description of *A. signatus* as well as with Dr. LeConte's description, that there can hardly be any doubt about the correctness of the determination. A number of other specimens, however, which were sent to Dr. LeConte were returned to us with the determination '*A. musculus* Say,' and trusting to Dr. LeConte's authority we have, in our correspondence, referred to this strawberry pest as *A. musculus* Say."

* NOTE.—Specimens collected at Ithaca, N. Y., years ago are nearly a third larger and much brighter colored than any observed this year about Washington.

A very careful comparison made at that time by Dr. Riley of a large series of specimens collected from strawberry plants showed a perfect agreement both with Say's description of *signatus* and with specimens identified by our highest authority on this order as *musculus*. It is not to be wondered at, then, that relying on the correctness of this determination of *musculus* he, as well as Mr. E. A. Schwarz, who indorsed this opinion (*Entomologica Americana*, vol. III, p. 14), should have been misled into the belief that the two species were identical, and to the adoption of the name *musculus* as having priority. At that time *musculus* and *signatus* were very generally misnamed in collections, owing to the fact that no one had studied them sufficiently. Since the appearance, however, of Dr. W. G. Dietz's paper on *Anthonomini* I have entertained some doubts regarding the identity of the strawberry species, recent examination of our entire material showing, as before, complete agreement of all forms as one species, viz, *signatus*. To decisively settle the doubtful point specimens were sent to Dr. Dietz, who also determined them as *signatus*. Subsequent examination shows that all our material found on Strawberry, including the specimens determined by Dr. Le Conte as *musculus*, belongs to this species. It should be added that there were no specimens of the true *musculus* in the National Collection at the time of publication of the first article. On the receipt of a pair kindly sent to the Department by Dr. Dietz, however, the specific distinctness of *signatus* and *musculus* was made clear, since with both species available for comparison their separation is not difficult. The beetle is illustrated at Figs. 15 and 16.

FIG. 15.—*Anthonomus signatus:* Adult beetle—natural size (after Riley).

Anthonomus signatus, as defined by Dr. Dietz, has the second joint of the funicle *distinctly* longer than the third. *A. musculus* differs in having the second joint of the funicle *scarcely* longer than the third, a difference which is usually apparent in fresh, but difficult to detect in old specimens without relaxing them. The thorax of the latter is less rounded on the sides and the suture is always darker.

Anthonomus musculus is apparently a much rarer insect than its injurious congener. Comparatively few specimens have been taken in this locality by local collectors, and its larval habits are still unknown. Dr. Hamilton (*Can. Ent.*, vol. XXIV, p. 41) says that it is not common at Allegheny, Pa., where he has found it exclusively on huckleberry blossoms from the middle of May till the first of June. It has been taken about Washington as late as July 10.

FIG. 16.—*Anthonomus signatus*: Adult beetle—natural size (original).

LIFE-HISTORY.

The Egg.—The egg of *Anthonomus signatus* is oval, and from about one-fifth to one-quarter longer than wide. The surface is perfectly smooth and highly polished. It is translucent, and the general color is a pale yellow. In size the egg is rather large in proportion to that of the adult insect. Measurements of different eggs showed a variation of from .48–.58^{mm} in length to .37–.47^{mm} in breadth.

Oviposition.—The greater part of two days was spent in an attempt to observe the method of oviposition, to secure eggs for study, and to ascertain the period of incubation. Although several females that were almost constantly under observation repeatedly punctured the buds, oviposition did not take place at this time. Subsequently, when the imprisoned insects had ceased work, eggs were discovered in these buds. Of the other buds that had been punctured in the breeding cages a few were opened and found to be empty. By this time it was too late to carry on this stage of the investigation, as the egg supply of the insects in confinement was apparently exhausted. Although the females did not oviposit while watched, it is presumed that some of the punctures were made for the purpose of oviposition, and enough was seen to demonstrate that this operation varies somewhat in method and time consumed according to circumstances.

The following notes, made on specimens confined in the breeding cages, may be of interest, although more extended observations are necessary to be of substantial value.

The first specimen—presumably female—consumed seven minutes in perforating the buds, when it withdrew, as if frightened. The second specimen was a female, and was accompanied by the male. She had just begun puncturing a fully-formed flower-bud when first seen. In two minutes she had inserted her rostrum the full length, *i. e.*, nearly to the eyes, or about on a level with the joints of her antennæ. She then immediately withdrew, and after resting a minute turned about and backed straight toward the punctured spot, which was plainly visible. Unfortunately at this juncture, although the back of the insect was toward the observer, she evidently became very much alarmed—about nothing as far as could be determined—the male evidently sharing in her anxiety. After running about, rather excitedly it was thought, for a few moments, she departed. During the entire time this female was accompanied by the male, but copulation did not take place.

Egg-laying on strawberry begins in this vicinity in April, probably as soon as the staminate buds begin to mature, and continues through May, or until the plants cease blooming. When the blackberries bloom, which they do about four weeks later than the strawberry, the latter is deserted and the blackberries attacked in turn.

Method of puncturing the Bud.—One specimen was watched while performing this operation that faced the observer, a second specimen was observed in an opposite direction, thus the method of work was noted.

In making the puncture the insect uses its whole body, all three pairs of legs performing their part. The insect's beak is worked, rather slowly, from side to side, and as the beak penetrates, the forelegs are gradually spread wider and wider apart as if pulling, while the hind pair are correspondingly elevated as if they were used to push the snout deeper, the middle pair of legs being used as a fulcrum. Naturally it takes longer to penetrate the calyx, but after this is once pierced through the work goes on more rapidly.

The method of cutting into the stem below the bud was not observed.

The Larva.—The larva of the Strawberry Weevil is of the usual Curculionid form, and, like so many others of this large family, offers no salient characters for specific description. In general appearance it resembles the familiar grubs or " worms " found in plums and cherries and in nuts and acorns—the larvæ of the Plum Curculio, and the Nut-weevils (Balaninus) respectively. The body is arched or curved, cylindrical, and strongly rugose or wrinkled and very sparsely covered with hairs. Like other Curculionids it is destitute of legs, their place being supplied by well-defined fleshy tubercles or pads as shown in the figure (Fig. 14 *d*). It is somewhat more slender than the larva of Curculionidæ generally, and slightly more slender than the example figured. The drawing was made from a larva which pupated the following day, and is consequently more robust than those a few days younger. The color of individuals, as has already been stated, varies from nearly white in those infesting the Blackberry to a decided yellow in specimens taken from Strawberry. The head is darker, brownish, and the mouth-parts are deeper brown, the color deepening at the dorsal anterior angles of the mandibles.

The average length of the full-grown larva in its natural curved position is 2^{mm}; greatest dorsal length about 3^{mm}.

Although no characters are discernible that might be construed as specific, some superficial characteristics might be mentioned. A noticeable peculiarity of the larva is its almost perfect helplessness when separated from its natural environment. Passing as it does its entire existence from egg to pupa in the bud, it has no need for organs of locomotion, and has evidently no means whatever of progression when placed on a flat surface. The mature larva remains almost constantly in a curved position, the dorsal line of the body describing about two-thirds of a nearly perfect circle.

The larvæ feed at first on pollen and the more tender parts of the unopened flower, the stamens and pistils, but when these are consumed the harder receptacle is attacked. In large buds only a small portion of the contents is consumed, the larva remaining on the side where hatched and gradually eating out a small hole around it, but in small buds it consumed the entire contents, leaving only the two outer envelopes. Numbers of such small buds were opened in which the larvæ were found full-grown and almost completely filling the interior with

their bodies and the accumulated excrement or frass, which is cast in the form of long, fine, curling black strings.

After attaining full growth the larva ceases to feed for a day or more and then transforms to pupa. If the buds are opened at this time it will be noticed that the inhabitants are very active, wriggling about constantly. These motions are continued by the pupa, which is exceedingly irritable if touched.

The Pupa.—A hollow cocoon-like receptacle or pupal cell is formed by the larva of the accumulated frass or castings, in the construction of which it uses some sort of sticky secretion or exudation, and this is then rolled smooth by the wriggling larva and pupa within. The constant motion of the insect as larva and pupa also serves to prevent it from becoming fastened to the sides of this receptacle. Within this cell the pupal stage is passed. This stage is shown at Fig. 14 *f.* A large proportion of specimens taken in the field had assumed the pupa state by the first week of June, and before the end of the week nearly all the imagos of this lot were disclosed. Pupæ were found this season from the latter part of May till the first week in July.

Issuance of the Imago.—The larva ordinarily remains on the side of the bud where the egg was inserted, and the adult beetle, when hatched, has only to cut through a thin layer of the dry calyx and corolla. The imago issues from a circular hole cut out on one side and usually at a point equally distant from the top and bottom of the bud. The place of issuance is often concealed more or less by an overlapping sepal of the outer row. Mature beetles, as has been said, began to issue during the first week of June, and nearly all the beetles of the lot from which these bred had developed within a week thereafter. From examination of the few buds of wild strawberry obtained, it is believed that the insect will average a week or more later on these, as no imagos were found until June.

The Insect probably single-brooded.—As to the number of annualgenerations the following facts would appear to indicate only a single brood.

First. None of the bred specimens in our vivaria were actually observed *in copula*, although they apparently paired in a few instances; consequently oviposition did not take place.

Second. The new brood of beetles which hatch in June disappears soon after maturing, and it is more than likely that they begin to hibernate at this time.

Third. This insect is in all probability, like many allied species, restricted to a single group of plants, the family Rosaceæ, and the possibility of a second brood necessitates a larval food-plant outside of this family, as no Rosaceæ bloom in this locality after the Wild Blackberry ceases to bear flowers.

Fourth. Late appearances of the beetles, such as have been recorded, are exceptional, judging from our own experience, and, although diffi-

cult of explanation, seems to be on a par with similar late occurrences of many other insects which might be mentioned.

Habits of the Adults.—The adult beetles, when not occupied in some manner in providing for the continuance of the species, may be seen sunning themselves in the flowers, or with their snouts buried among the anthers feeding on pollen.

There are reasons for the belief that it is principally the males that loiter within the blossoms, where they wait for their mates, while the latter are busied in the more serious occupation of oviposition. Pollen furnishes apparently by far the largest proportion of the adult food supply, but the petals are also nibbled and often completely destroyed. A certain amount of liquid food is necessary to these little creatures and a quantity of the juice and of stem tissue is doubtless absorbed while puncturing the buds and stems during the process of oviposition. The leaves are never attacked as far as observed. In the breeding cage a number of beetles were found feeding upon the pollen of injured buds, that had been opened and were old and brown. Numbers congregated on the immature fruit where they fed upon pollen and possibly on both stamens and pistils, and still others were seen to penetrate the unexpanded buds in search of food. It is somewhat uncertain whether the insects act in this manner in the field, but it is likely that they do so to a certain extent, for in cases observed in confinement there was an abundance of blossoms in the cage and there was no reason why the insects should have acted otherwise than in nature. Many buds were opened, particularly late in the season, that had been killed by the insects and in which neither eggs nor larvæ could be found.

In puncturing the buds for feeding purposes the motions of the insect are substantially as when drilling a hole for oviposition, but with the addition that the insect partially withdraws its beak from time to time, as if to masticate, and devour what particles had been dislodged, and then again plunges it in at a different angle.

As to the other habits of these beetles they are comparatively sluggish, but more active than many of the Rhynchophora. They seldom fly, but crawl from one part of a plant to another and even across the ground when they wish to reach other plants. Their flight, as observed in a large breeding cage, is quite rapid. Although ordinarily so loth to take to wing I have seen a male insect fly a distance of two inches to reach a female perched on a flower belonging to another plant. It is probable that the females fly less often than the males.

When busily feeding with their snouts in a flower they are not easily alarmed, but when not so engaged they quickly roll to the ground if disturbed and remain there with their legs and antennæ rigidly drawn together, after the manner of their kind. On bright, warm days, however, they seldom remain thus more than a minute at a time.

At the times when the strawberry fields were visited comparatively

few of the beetles were at work in the flowers in the mornings, but later, in the heat of the afternoon, they were much more numerous.

Summary of the Life-history.—A brief summary of the life-history of this species, based on the past year's observations in this locality, is given herewith.

The insect undergoes true hibernation, *i. e.*, in the adult state, and in April individuals of this hibernating brood begin to crawl forth from their winter quarters, fly to the nearest flowers, and commence feeding. They probably continue to issue from their hiding places for a month after the first arrivals make their appearance.

Strawberry buds are attacked as soon as they are fully matured. Staminate varieties begin blooming in the neighborhood of Washington as early some seasons as the second week in April, and it is probable that they begin their bud-destroying labors here at least by the middle of April, egg-laying commencing at this time and continuing through the month of May, although the principal damage to this crop is done from the latter part of April till toward the middle of May.

Blackberries are invaded in turn at the time that the plants begin blooming, or about four or five weeks later than the Strawberry. Wild Blackberry is visited still later and the beetles continue on this plant for some time.

The injury to these plants is done by the female in the course of oviposition, and is produced by puncturing the stems just beneath the buds, causing the death of the plant above the point of attack. A single egg is deposited at this time in each flower-bud.

The larvæ are believed to hatch within from three to five or six days after the egg is deposited in the bud, and probably attain their full growth three or four weeks thereafter, when they transform to pupæ.

The pupal stage lasts from about five to eight days, according to thermometric conditions, and the first mature insects of the new brood begin to issue from the strawberry buds toward the end of May, continuing through the month of June, and in exceptional cases into July. The beetles are so seldom seen after the middle of July that they are believed to begin to hibernate at this time.

Our observations indicate only a single annual generation.

All of the earlier stages of the insect are passed in the bud. It never attacks the fruit.

PARASITES AND NATURAL ENEMIES.

Four species of parasites were bred during the season from the Strawberry Weevil, two species of Braconidæ and two Chalcidids of the subfamily Pteromalinæ. One of these, *Calyptus tibiator* Cr., is described; the remainder are new and are described in the note appended by Mr. W. H. Ashmead, who is making a special study of these forms.

Calyptus tibiator Cr. was by far the most abundant species of this year. Specimens issued from June 10 to 20.

Bracon anthonomi Ashm. A single specimen was found in its web in a strawberry bud in the field June 3, from which the imago issued June 20.

Catolaccus anthonomi Ashm. Two specimens, male and female, were reared from strawberry buds June 8 and 9.

Catolaccus incertus Ashm. was nearly as abundant as *Calyptus tibiator*. Adults issued June 7 to 12.

All of these parasites were bred from buds gathered late in the season. A single example of *Calyptus tibiator* was obtained from a bud taken in June. The two commoner species breed indifferently in Strawberry and Blackberry, both cultivated and wild. All are primary parasites and normally solitary, only a single individual infesting the host insect.

No insects, birds, or other animals have been observed preying upon Anthonomus in the field, but it is probable that a few species do so to a limited extent. Only two species of predaceous insects were even seen on infested plants, both occurring on Wild Blackberry. These were a pair of *Phymata wolfii*, a Heteropteron well known as an enemy to Lepidoptera and to bees, and two examples of Cleridæ. The former species was probably in search of larger game, but the Clerids, *Clerus rosmarus*, might have been engaged in devouring the strawberry weevils. This species is known to live upon other small beetles, and our captures readily devoured the strawberry weevils in confinement.

REMEDIES.

A number of remedies have been suggested, a few have been experimented with, but none, so far as I know, have been actually tested.

Of insecticides, the arsenites are of doubtful value, and there is possible danger of poisoning the fruit. As already pointed out in Dr. Riley's article on this subject, the kerosene emulsion, or pyrethrum dusted on the plants, would doubtless prove effective against the adult insect while at work, and gas-lime, or saw-dust impregnated with crude carbolic acid, or some other repellant, might be tried.

Now that the life-history of the insect is known, a number of other remedies suggest themselves.

In the first place, where staminate berries are extensively grown for the market, all wild plants and old strawberry beds that might serve as breeding places for this and other pests should be burned and cleaned away. There can be little doubt that the species under consideration, *Anthonomus signatus*, is derived from the Wild Blackberry, and unless the strawberry beds are completely covered over as described later on, all these wild bushes in the neighborhood of the strawberry beds should be destroyed.

Another remedy would be to collect the injured buds and place them in a box or barrel covered with cloth or wire-netting with meshes just large enough to permit the escape of the parasites, which are consid-

erably smaller than their host, but small enough to retain the beetles. A fine mesh of what is known as bobbin-net mosquito netting would answer the purpose admirably. It is somewhat doubtful if this remedy would be profitable except on small beds. The parasites are undoubtedly of great value in keeping this insect in check, but it is probable that none of the four species observed this year are peculiar to the Strawberry Weevil.

Taking advantage of our knowledge of the preference of this insect for those varieties of berries which bear an abundance of pollen, we might use the earliest staminates as a trap crop for the hibernating brood of beetles.

Trap Crops.—A few of these plants, *e. g.*, "Stevens," "Michel," "May King," and "Hoffman" varieties might be planted in or near beds of late growing berries, and the insects destroyed daily by the application of insecticides, or, if sufficiently abundant, by beating them from the flowers into pans filled with water, covered with a thin scum of kerosene.

As a trap for the new brood which hatches about berry-picking time, the Wild Bergamot should produce excellent results. It has been demonstrated this year that sweeping and beating after the second week in May are of no avail against the early brood and it is doubtful if these methods would be of much service in capturing the beetles when more numerous early in the season on account of their habit of dropping to the ground at the slightest alarm. But still later in the season the insect may be readily captured with an ordinary sweep net. They fairly swarm on the Wild Bergamot or Horse-mint when this plant begins blooming during the latter part of June and thousands can be captured at this time and destroyed. Later, after the first week in July, the beetles are scarce. This plant has a wide distribution, being found from New Hampshire south to Florida and particularly westward. It is a common and well-known species, but for the benefit of any who may not recognize it by either of its popular names, it may be said that the flowers are large, showy, and purplish or rose-colored, looking somewhat like gigantic heads of Red Clover. The plant often grows in dense masses and to a height of from 2 to 5 feet. The stem is square, leaves opposite, and the flowers have a powerful and persistent and rather agreeable odor. It is quite hardy and can doubtless be readily transplanted or grown from the seed, and if properly cared for might serve as an ornament, as well as an insect trap.

Our surest remedy, however, would be preventive.

Covering Beds as a Preventive.—As a preventive it is only necessary to cover the plants with some light material, such as muslin or ordinary mosquito netting. Mr. Fletcher has suggested the use of old newspapers for this purpose and possibly they might prove of considerable value. They should be placed with their edges overlapping and held down with stones or clods of earth.

A certain remedy, however, would be found in covering the beds with frames of muslin. I would strongly advise this remedy where "Sharpless" and the like are extensively grown.

As to the method of covering, this is a matter which might, perhaps, as well be left to the ingenuity of the grower. A good plan has been devised by Mr. O. W. Blacknall, an account of which will be found in *Garden and Forest* for February 10, 1892 (p. 68). Mr. Blacknall's method has been followed for a number of years, for forcing strawberries, and is described as inexpensive and effective. By it he succeeds in obtaining strawberries a week and even ten days earlier, of superior size and quality, and in addition they are protected both from frost and, if pollen bearers, from our Strawberry Weevil.

The benefit derived from this plan is then, four-fold, viz., protection from frost, and from insects, earlier, and stronger growth. Mr. Blacknall also believes that the process of pollenization is aided, the cloth covering serving to keep the pollen-laden currents of air nearer the ground and among the plants. The material used is known as tobacco cloth or plant-bed cloth and costs about 2 cents a yard. The following is an abstract of his method:

After many experiments in search of a cheap and effective way of holding the cloth in place, I use small sticks of riven pine, known here as tobacco sticks, which are about three-quarters of an inch square. These sticks are sawed up into stakes fifteen inches long, and sharpened at one end. The other end for about half-way is smoothed with a drawing-knife and a wood rasp if necessary, so as to remove all splinters and irregularities which could tear the cloth. A very small hole is then bored about one inch from the smooth end. Into this hole a section of small, soft wire, say No. 17, about six inches long is run and bent around and wrapped on itself so as to hold securely. The other end of the wire is bent either before or after putting in the stake into a hook to hold the cloth. The hook should extend about three inches clear of the stake.

These stakes should now be driven into the ground for about half their length, placing them three feet apart in rows thirty-four inches apart, as some allowance must be made for the shrinking of the cloth, which is a yard wide. Turn the hooks the way the rows run, and let them all point in the same direction.

They are now ready for the cloth. If the hooks set to the east—and I set mine that way as our hardest winds come from the west—begin at the western end of the row. Run the hooks through the selvage of the cloth on each side and lock the outside row of hooks as you go, by twisting the wire around on itself. Leave the inside row of hooks open till you bring up the other width of cloth. Then when the selvage of that is caught on them lock those hooks, leaving what is then the inside row unlocked to hold the cloth on the next trip up. Always go back to the same end to start. When the bed is covered lock the outside row of hooks also.

Your bed is now covered solid with cloth except for the small gaps along the rows of stakes, and if they are placed in straight rows and driven perpendicularly, the gaps will be too small to do any harm. As the cloth is stretched only four inches from the ground and is quite elastic, snow presses it down without tearing it. When the danger from snow is past and the plants about ready to bloom, the covering can by a few minutes' work be raised to quite eight inches from the ground, in this wise: Begin at the end opposite to that on which you began to attach the cloth and bend the soft wire hooks straight upward over the stakes and leave them there. The cloth is so elastic that it can be walked on without injury except very near to a stake.

When the berries ripen remove the cloth, fold and tie it up neatly. Well handled it will last three years. The stakes should be pulled up and kept where the hooks will not rust too badly.

The covering in any case should be placed over the beds before the plants begin to blossom and attract the beetle, and may be removed when the crop is harvested. If so crude a remedy as old newspapers be used, these would probably better be removed after remaining for two or three weeks.

It has for some time been customary to burn over strawberry beds as soon as the fruit has been harvested, as a preventive of rust and various insects. This is a most excellent practice, but is probably of little avail against the Strawberry Weevil, as by the time the berries are picked the insects have practically all left the vines.

It is earnestly requested that such of our readers as may have an opportunity during the coming season to test the remedies herein suggested will report results.

DESCRIPTIONS OF THE PARASITES MENTIONED.

BRACON ANTHONOMI sp. n. Ashmead.

Male.—Length, 2^{mm}. Brownish-yellow; stemmaticum, occiput, and antennæ black; antennæ 26-jointed, a little longer than the body, with the flagellar joints about twice as long as thick. Thorax smooth, polished, the mesonotum trilobed, the lateral lobes being slightly dusky near the tegulæ. Wings greyish-hyaline, the stigma and venation fuscous; second abscissa of radius very slightly more than twice the length of the first; recurrent nervure not interstitial, joining the first submarginal cell before its apex. Legs yellowish, pilose; last joint of anterior tarsi, middle and posterior tarsi, and the posterior tibiæ toward hips, fuscous. Abdomen elliptic-oval, granulated, the first segment with a V-shaped sulcus, the inclosure thus formed convexly elevated; first and second segments about equal and a little longer than the others; following segments very slightly subequal.

Hab.: Washington, D. C.

Described from a single ♂ specimen, reared June 8, 1892, from *Anthonomus signatus.*

CATOLACCUS ANTHONOMI sp. n. Ashmead.

Female.—Length, 2.8^{mm}. Blue; head and thorax faintly tinged with metallic green; flagellum brown; scape, trochanters, tips of femora, and the tibiæ and tarsi honey-yellow; coxæ and femora bluish, the hind coxæ punctate, the inner ridge with a fine pubescence. Head and thorax confluently punctate; frons impressed; ocelli red; clypeus sinuate at the middle. Antennæ 13-jointed, inserted on the middle of the face; scape slender, cylindrical, about half the length of the flagellum; pedicel smaller and slenderer than the first flagellar joint; flagellum cylindrical of nearly a uniform thickness throughout, the club being scarcely thicker

FIG. 17.—*Catolaccus anthonomi* Ashm., enlarged (original).

than the funicle, the first funicle joint being a little the longest joint, the following joints scarcely perceptibly subequal. Thorax ovoid, the collar rounded, nearly of an equal length throughout; parapsidal furrows indicated only anteriorly; metathorax two-thirds the length of the scutellum, the spiracles close to the postscutellar fold, elliptic-oval, the lateral folds complete, and there is a slight median carina at base. Wings hyaline, the venation pale yellowish, the stigmal vein two-thirds the length of the postmarginal ending in a small stigma, the marginal vein about as long as the postmarginal. Abdomen conic-ovate, about as long as the head and thorax together, subsessile, its base slightly produced beneath the neck of the metathorax, segments 1, 5, 6, and 7 about equal in length, about as long as the 2, 3, and 4 combined, 2 and 3 very short, together only slightly longer than 4.

Male.—Length 2^{mm}. Golden green, confluently punctate; scape and legs, except hind coxæ and femora, yellow; the tip of the hind femora also yellow; flagellum pale brown, pubescent; the pedicel small, smooth, dusky; terminal joints of funicle very slightly longer than thick; the basal joints about $1\frac{1}{2}$ times as long as thick. Abdomen oblong-oval, the first and fifth segments the longest; the other segments, except the last, short, about equal in length.

Hab.: Washington, D. C.

Described from 1 ♂ and 1 ♀ specimen, reared June 8 and 9, 1892, from *Anthonomus signatus.*

CATOLACCUS INCERTUS sp. n. Ashmead.

Female.—Length, 2^{mm}. Head and thorax metallic green, confluently punctate, covered with rigid white hairs; abdomen conic, subcompressed, bluish black; scape, trochanters, apices of the femora and tibiæ and tarsi, honey-yellow, the hind tibiæ dusky at the middle; flagellum subclavate, brown, the first funicle joint the longest, about $1\frac{1}{2}$ times as long as wide, the others very slightly subequal, the last being very slightly longer than wide, the club 3-jointed, slightly stouter than the funicle, the second joint the longest and widest. The head is a little wider than the thorax, the vertex therefore wide, the ocelli arranged in a slight curved line, the clypeus medially emarginate. Thorax ovoid, the collar distinct but short, the mesonotum wider than long with the parapsidal furrows indicated only anteriorly, scutellum convex, metathorax half the length of the scutellum, punctate, with a slight median carina at base, the spiracles oval close to the post-scutellar fold, the surface behind them deeply depressed, with no lateral folds. Wings hyaline, the venation brownish-yellow, the stigmal vein clavate about half the length of the marginal, the club brown, the marginal vein two-thirds the length of the submarginal, the post-marginal vein one-half longer than the stigmal. Abdomen as long as the head and thorax united, the first body segment and the third about equal and slightly longer than any of the others.

Male.—Length, 1.1^{mm}. Dull bluish or blue-black, with sometimes a slight bronzy tinge on the head and thorax above, the rigid pubescence subobsolete; second abdominal segment, scape, knees, tips of tibiæ and tarsi, except the last joint, honey-yellow, or whitish yellow; flagellum, brown, covered with a fine, long pubescence, the pedicel stouter and about twice the length of the first funicle joint, the following joints about equal, a little longer than thick; the club pointed, usually contracted in drying and not as thick as the funicle.

Hab.: Washington, D. C.

Described from 2 ♂ ♂, 1 ♀ specimen; reared June 7, 1892, from *Anthonomus signatus.*

DAMAGE TO FORESTS BY THE DESTRUCTIVE PINE BARK-BEETLE.

(*Dendroctonus frontalis* Zimm.)

By A. D. Hopkins, *Morgantown, W. Va.*

It appears that an unhealthy condition of the pine forests in West Virginia and Virginia has existed in certain points in the Allegheny Mountain range and adjacent foothills since about the year 1888, but had only attracted local attention until within the last two years, when its rapid spread and increasing devastation brought the matter to public notice, and it was referred to this Station, and to me, for investigation. I have, therefore, made two extended journeys through the eastern portion of our State, one in May and the other in July of this year, for the purpose of ascertaining the character and cause of the trouble and the extent of the damage, and also to discover, if possible, a remedy.

It was found that when this trouble commences in a healthy forest groups of trees numbering from two to a dozen or more are noticed dying the first year. The foliage on such trees first turns yellow and then red, as if killed by fire. The second year this peculiar condition will have spread until the groups of dying trees extend over one to ten or more acres; and by the third year the entire forest of pine trees of all kinds, on hundreds of acres, is often found dead and dying.

After studying all the conditions found, and a due consideration of all the visible and probable elements which might produce them, I was convinced that a single species of Coleopterous insect, *Dendroctonus frontalis*, was to blame for the primary attack and resulting death of the trees.

From personal observation it is found that the dead and dying condition of the Pine extends from near the Pennsylvania line in Maryland on the north; through Hampshire, Hardy, Grant, Pendleton, Randolph, Pocahontas, and Greenbrier, to Summers and Raleigh counties in West Virginia on the south; and from inquiry and correspondence I learn that the same condition extends through about an equal area in Virginia. Therefore, it would seem that the ravages of this beetle extends over an area of at least 10,000 square miles, including portions of West Virginia, Virginia, and Maryland, on which five species of Pine and Black Spruce are being damaged and killed to a greater or less extent by them. In certain sections entire forests of Pine, including all species on several square miles, are dead, and have been a total loss. The greatest destruction has been in the forests of the common Pitch Pine (*P. rigida* Miller), and the Scrub Pine (*P. inops* Ait), and in the less common but more valuable Yellow Pine (*P. echinata* Mill).

The extensive and valuable forests of Black Spruce (*Abies* [*Picea marianna*] *nigra* Pain), and White Pine (*Pinus strobus* L.) in West Virginia, are being invaded by the insects; therefore, owners who have large in-

terests in such timber are becoming alarmed. The ravages of the insects in the other pines have been of such a serious character, the spread so rapid, and the destruction so complete, that there is really good cause for alarm, and should this destructive work continue in the Spruce and White Pine of our State, and the invasions of this insect extend into the great pine forests of the Southern States, many millions of dollars will be added to the great loss already sustained.

REMEDIES CONSIDERED.

At first, a remedy against the rapidly spreading ravages of the beetles seemed out of the question, but when it was found that they had just commenced their attack upon the forests of Black Spruce and White Pine, it indicated that possibly some method could be found by which the healthy and more valuable portions of these forests could be protected.

The method of cutting and burning the first infested trees to destroy the insects was considered, but it was found that it could not be generally practiced in our West Virginia forests, owing to many difficulties and conditions rendering this as well as other like methods impracticable.

The occurrence of a similar trouble in our Spruce forests between 1882 and 1889 caused, evidently, by the Spruce-bark Beetle (*Polygraphus rufipennis*), was, I have every reason to believe, brought to an end principally by the appearance of some six species of parasites and predaceous insects, which were found preying upon it. This, together with the well-known success of the introduction of the *Vedalia cardinalis* from Australia into California, resulting in the destruction of the Icerya, led me to consider similar methods of combating the Destructive Pine-bark Beetle, and to carry into effect a previously contemplated experiment of introducing certain insects from Europe to feed upon some of our injurious bark beetles.

By correspondence with Mr. Eichhoff, Oberförster, Strasburg, Germany, I learned that a certain beetle, *Clerus formicarius* L., was a "great destroyer of Scolytids" in the forests there, and from my knowledge of the habits of the nearly-related species, *Thanasimus dubius* Fab., I felt that it would be a most desirable species to introduce into our forests to feed upon the "Destructive Pine-Bark Beetle," and possibly check its ravages. Therefore, the experiment of introducing this beneficial European species into our State for this purpose was recommended to our Station officials and to owners of the threatened Spruce and White Pine forests. This proposed experiment was at once approved and the Station, aided by liberal contributions from four of the principal lumber companies, sent me to Europe in quest of such insects as, in my judgment, would, when introduced into our forests, accomplish the desired end. I, therefore, proceeded at once to Germany, sailing from New York on August 17, and arriving at Strasburg on Au-

gust 27, and after visiting some of the principal Pine and Spruce forests of Alsace-Lorraine and Saxony, in Germany; Schwyz, Lucerne, and the Oberland Bernese Alps in Switzerland, I started back to America on September 25, with over one thousand live specimens of *Clerus formicarius*, which was found to be especially destructive to various bark beetles in all of the forests visited. After my return here on October 8, I found that the European species would readily attack and devour the Destructive Pine-Bark Beetle, as well as other bark beetles nearly related to it.

From what I have observed and learned of this European bark-beetle destroyer, I am confident that under proper management it will check the ravages of the destructive pine-bark beetle, and that this enemy of scolytids will, in time, prove a valued protector of the pine and spruce forests of this country. We have, therefore, arranged to introduce the beetle into our infested forests in the greatest possible numbers.

A detailed account of the investigations referred to in this article will appear in a forthcoming bulletin, to be issued from the station at an early date.

AN INTERESTING WATER BUG.

(*Rheumatobates rileyi* Bergroth).

In INSECT LIFE (vol. IV, December, 1891, pp. 198–200) we described and figured a remarkably interesting aquatic Heteropter, captured by the Rev. J. L. Zabriskie, of Flatbush, L. I., in July, 1890, in the stream of the waterworks at Flatbush. We stated in our brief notice that the insect was plainly a member of the family Hydrobatidæ and came closest to Metrobates.

Soon thereafter we received the communication from Dr. E. Bergroth, of Tammerfors, Finland, which is published in INSECT LIFE (vol. IV, p. 321), in which he says: "The insect undoubtedly belongs to a new genus and species, which I propose to name *Rheumatobates rileyi*. It is, with the recently described genera Hermatobates Carp. and Hemidiptera Leon, one of the most curious and interesting Hydrometridæ hitherto discovered."

We have been anxious to obtain further specimens of this curious insect, and Mr. O. Heidemann has recently succeeded in finding it in numbers, in both sexes, along the Potomac Canal, just above Washington. Through his kindness in donating a number of specimens to the National Museum, we are enabled to present herewith a full description of both sexes of the imago, as well as of the adolescent states. The excellent figures which accompany the article have also been made by Mr. Heidemann, who, in addition to being our chief Washington student of the Heteroptera, is an expert draftsman and engraver.

Aside from the peculiar structures of this insect it is interesting in furnishing two forms of the male; a normal form departing less from the family type than the abnormal form, which has characteristically enlarged and spinose antennæ and swollen and curved hind thighs. In these two specialized characters, however, there is considerable variation, in some specimens the antennæ being twice as thick as in others, while again the hind thigh is sometimes much less noticeably thickened and curved, but approaches more nearly to that of the normal male.

There is also slight variation in all details, both as to coloration and relative proportion of joints, and detailed armature of legs and antennæ, a fact which is brought out very strikingly by the examination of over 200 specimens.

RHEUMATOBATES RILEYI Bergroth. *Imago* ♂ (abnormal form).—Length 2.2 to 3mm. Velvety black, disc of abdomen slightly pruinose; under side of head and thorax, anterior coxæ, except behind, basal two-thirds of anterior femora, middle coxæ beneath and at base, hind coxæ, basal part of hind trochanters, a central spot on

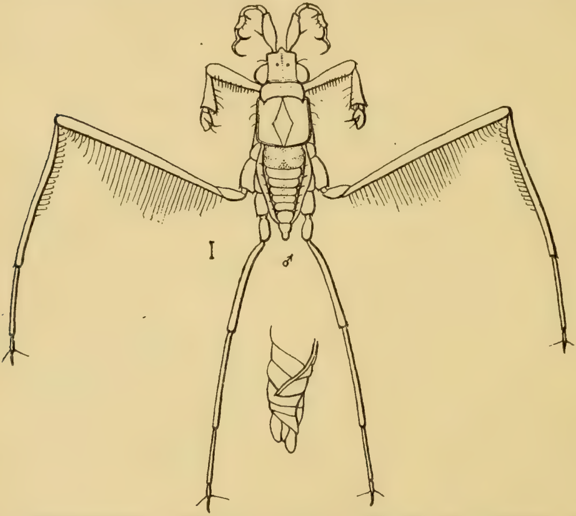


FIG. 18.—*Rheumatobates rileyi*—normal male, enlarged, the lower figure showing abdomen from side (Heidemann, del.).

each ventral segment on lateral margins of abdomen, basal one-third of first antennal joint, a transverse subquadrate spot on pronotum and either a triangular, heart-shaped, lozenge-shaped, or linear spot on mesonotum, all yellow or yellowish-white; on mesopleura, some distance above middle coxæ, is an oblong darker yellow spot. Head about as long as width between eyes; tylus prominent, about as long as wide. Eyes large, subglobular, strongly faceted, with a tubercle beneath and furnished with two or three long hairs issuing from posterior margin. Rostrum 3-jointed, short, stout, acuminate at tip, and extending to between anterior coxæ; joint 1 stoutest, about as long as 3, 2 slightly longer than 1 and 3 together, acuminate. Antennæ

4-jointed, two and a half times as long as head; joint 1, two-thirds as long as anterior femur, stout, swollen at middle, with some sparse hairs; beneath, slightly beyond middle, armed with a strong truncate spine and a little before this spine with a tuft of stiff bristles; joint 2, not quite as long as thick, armed with an acute spine at the extreme base below; joint 3, rather strongly curved and slightly twisted, basal three-fourths cylindrical, apical one-fourth enlarged, with a pale oval disc or cushion beneath, its margin surrounded by several bristles; joint 4, rather more than one-half as long as 3, acute at tip and giving off a short tubercle below, a little beyond middle. Thorax and abdomen together subovate-acuminate, a little more than three times as long as wide; pronotum large, transverse, three times as wide as long, with posterior angles rounded; mesonotum three times as long as pronotum; metanotum not visible from above. Abdomen conical, with lateral margins slightly reflexed, and terminating in a conical point; at base nearly as wide as thorax; joint 1 occupying nearly one-third of the surface; 2 to 8 short, subequal; 9 longer, conical. Anterior legs short, stout, pubescent; femora slightly longer than tibiæ and tarsi together, fringed beneath with a single row of black bristles; tibiæ, about half as long as

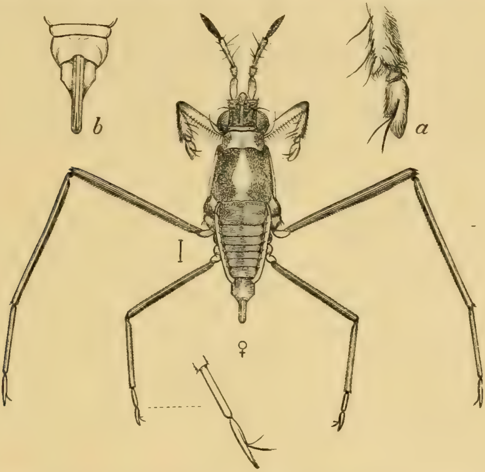


FIG. 19.—*Rheumatobates rileyi*—female imago, with the hind tarsus enlarged; *a*. tarsus of foreleg; *b*, anal segment from below—still more enlarged (Heidemann, del.).

femora, with three or four long bristles beneath; tarsi short, 2-jointed, about two-thirds as long as tibiæ, joint 1 one-half as long as 2, last joint emarginate beneath a little before apex, from which emargination issues a single black claw; from base of claw springs a stiff bristle which could be mistaken for a second claw. Middle legs much the longest, cylindrical, tapering toward tarsi, fully four times as long as anterior pair, or one-fourth longer than posterior pair; femora, one-fourth longer than tibiæ, fimbriate, with long hairs beneath; tibiæ, with only basal half fimbriate, hairs usually hooked or curved; tarsi, about one-third shorter than tibiæ, 2-jointed, joint 1 about twice as long as 2, the latter emarginate beneath at about basal one-fourth, with a single claw and a bristle. Posterior legs with femora stout, strongly curved, and acutely produced at apex beyond articulation of tibiæ, tip furnished with several long hairs; a little before tip is a spine-like process or prong, with a tuft of bristles near base; basal, third of femora within with a row of long hairs; joint 2 of trochanters large, densely hairy above and below; tibiæ, subclavate, articulating

with femora, outwardly, a little before the apex and slightly curved in opposite direction; inwardly, at basal one-fourth, is a tuft of very long bristles, usually closely united and having the appearance of a long spine; upper margin fimbriate with usually a tuft of hair outwardly some distance from apex; tarsi, long, slender, a little longer than tibiæ, 2-jointed, joint 1 very long, almost as long as tibia; joint 2, short, scarcely more than one-sixth the length of 1, contracted beneath at basal third, the origin of the single long, slender claw, and an accompanying bristle as with the other tarsi.

♂ *Normal form* (Fig. 18).—This is the most common form found associated with the females. It agrees fairly well with the abnormal form, except as follows: Slightly larger, average length from 3 to 3.1^{mm}; joint 2 of antennæ with no spine at base within, joint 4 being longer; prong-like process also longer and situated before middle of joint; anterior legs short, stout, not quite half as long as the posterior legs, tibiæ and tarsi together not longer than femora, the latter bare, with a row of black bristles beneath; tibiæ twice as as long as tarsi, covered with a short dense pubescence, with two long hairs beneath; tibial spur blunt and apparently composed of a tuft of stiff bristles; tarsi 2-jointed, first joint very small, second long, apical half beneath emarginated, base of emargination being the point of origin of the single large claw and a long black hair or bristle; middle legs very long, one-third longer than hind legs, cylindrical; femora but slightly longer or not longer than tibiæ, with a fringe

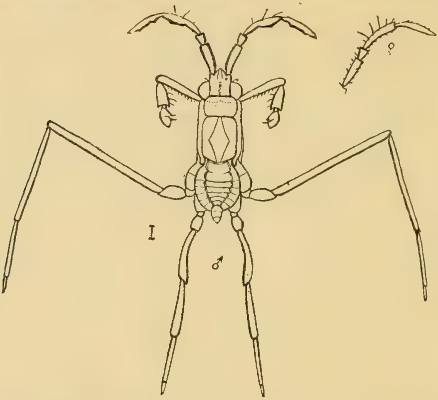


FIG. 20.—*Rheumatobates rileyi;* male larva, enlarged, with female antenna shown at right (Heidemann, del.).

of very long hairs beneath at middle, fringe at the distal ends shorter, hairs usually curved; tarsi two-thirds as long as tibiæ, 2-jointed, joint 1 three times as long as 2; joint 2 emarginate beneath near middle with a single claw and a bristle; hind legs much shorter, not fimbriate beneath, femora almost straight, not thickened or curved as in the abnormal form, and a little shorter than tibiæ; tarsi 2-jointed, joint 2 shorter, only a little more than one-third as long as 1, emarginate beneath at about one-third its length for the reception of the long slender claw; abdomen relatively longer, last segment conical. It also differs somewhat from abnormal form in color, the yellow marks being more variable. The pale blotch on the mesonotum sometimes subobsolete or entirely wanting; head black beneath, mesosternum pale, but with a large V-shaped black spot or medially black with an inversely V-shaped yellow spot, while the venter is usually entirely black.

Imago ♀ (Fig. 18).—Readily distinguish from ♂ as follows: The antennæ are always slender, without spines or processes; joint 3 furnished with long hairs; joint

1 with basal half white; yellowish white spot on the mesonotum always present, diamond shaped or elongate; tip of the abdomen terminating in a long style-like process, little more than four times as long as thick; dorsal abdominal segments large with an obconical white spot at apex; venter whitish; legs never fimbriate beneath; middle coxæ outwardly at base with a small white spot never present in male; hind femora distinctly longer than tibiæ, tarsi only about half as long as tibiæ, rarely a little longer.

Larva ♂ (Fig. 19).—Length about 2^{mm}. Differs from the imago in having spines and processes of antennæ undeveloped, although relative proportions of joints are about the same, joint 3 having 3 long hairs, but without specialized disc; 4 a little dilated below at middle, where in a future stage issues the prong-like process of imago: legs without fimbriæ beneath; anterior tibiæ and tarsi being shorter comparatively and stouter than in either of the forms of the imago: abdomen much shorter than thorax, margins dilated, dorsum concave, joints 8 and 9 conjoined and issuing as a conical projection from an emargination in joint 7.

Larva ♀.—Differs from male larva in having antennæ always slender, and the joints without spines or processes, joint 3 only with several long hairs; abdomen very short, joints 8 and 9 forming a long cone-like projection; hind legs a little more slender than in male larva and in proportion to middle legs a little shorter; relative length of the joints differing, tibiæ much shorter than femora; tarsi somewhat shorter than in ♂; whitish or yellowish spots less distinct.

The following table will indicate the difference between Rheumatobates and Metrobates, to which it comes closest, as we stated in our earlier article:

Metrobates.

General form oval obese, antennæ ♀ with the first joint very long and slender, as long as the three following united, or about as long as the front femur; second joint longer than the third.

♂ antennæ slender, the first joint very long, subclavate, a little longer than the three following united, fimbriate beneath; second joint nearly as long as the two following united; joints 2 and 3 thickened at tip with a small tuft of bristles beneath.

Legs simple, normal, with no fimbria beneath.

Rheumatobates.

General form elongate, subovate, antennæ ♀ with the first joint short, scarcely one-third the length of the front femur; second joint very short, about one-third the length of the third.

♂ antennæ stout, the first joint much swollen, shorter than the three following united, with a stout strong spine beneath near the middle; second joint very short, only about twice as long as thick, in fully formed ♂ with a spine at base within; third joint longer than the fourth, curved and thickened at tip, with a large disc beneath and a spine; fourth joint with a prong-like process.

Legs in ♂ with middle femora and tibiæ strongly fimbriate, the hind femora strongly curved in abnormal form, etc.

The peculiar disc-like organ or enlargement of the short antennal joint near the apex below exists only in the male sex. It varies in size with the age of the individual. In the very young larva it is not present and there is only a slight thickening of this portion of the joint. In the older larva it is present in a more or less rudimentary form and attains its highest development in the adult. It consists of a broadening of the under surface of the joint, the face assuming a whitish membranous appearance, slightly concave, with a slight ridge at the mar-

gins of the concavity, and its rim is surrounded by long sparse bristles. Studied under the high power of the microscope the face is seen to be furnished with sparse short hairs each arising from a slight tubercle. In younger individuals the surface is very faintly pubescent. There is nothing in its intimate structure to suggest a sucking disc and it is probable that Dr. Bergroth's inference that it might be such an organ is incorrect. It should be stated that at the time Dr. Bergroth made this suggestion we knew only this sex and the very fact that the female does not possess it goes to prove that it is not developed for the purpose of enabling the insect to cling to stones in swift currents as was hinted. It is undoubtedly a secondary sexual character and unless it possesses some important office in the act of coition it will be difficult to surmise its *raison d'être*. There is a possibility that its function is sensory, but we have not had the opportunity to study its nerve supply.

At our request Mr. Heidemann has prepared the following account of his observations upon the habits of the species:

"This interesting bug lives in clear running waters, and seems to prefer points where the bed of the stream is rocky. I was unable to find specimens at any other point on the canal, except at one very rocky spot. I found the insects skimming over the surface of the water in considerable numbers and in the same lively manner as do the insects of the allied genera Metrobates and Stephania. They were very shy and dived quickly beneath the surface when approached, and were therefore difficult to capture. On the sides of the canal where there was only a little ripple on the water I saw them more active immediately above stones covered with slimy mud. I also noticed a few specimens of Stephania in company with them. I captured with my net specimens in all stages of development, from the young larva up to the full grown adult. It is my opinion that there is more than one brood during the year, since on the 4th of June I captured a single larva on the same spot. I did not, however, at that time recognize its true affinities."

EXTRACTS FROM CORRESPONDENCE.

Further Notes on the Japanese Gypsy Moth and its Parasites.

I read with interest the report of the meeting of the Gypsy Moth Commission, which appeared in INSECT LIFE, VOL. III (p. 368).

I have had but one poor specimen of *Ocneria dispar* to compare my specimen with, but having heard that *dispar* was in Yezo, and as the appearance and habits are so nearly identical, I took it for granted that it was *Ocneria dispar* without careful examination.

Your statement that *Ocneria japonica* is somewhat larger than *dispar* is not conclusive to my mind that the two are not identical. We have specimens of *Pieris rapæ* that reach a maximum of two inches and three-quarters, and *Papilio machaon*

attain an expanse of five and a quarter inches. Is it not possible, therefore, that the larger size and even other variations are due to temperature changes?

In the Report of the Transactions of the Asiatic Society for Japan, dated June, 1875, Mr. Pryor says "he has found some Japanese insects the larvæ of which are quite different from the British ones, but the imago is the same." He has proved by actual breeding that the temperature alone causes extraordinary changes.

I find on examination that what you call *Ocneria japonica* is given in Pryor's List of Japanese Moths as "*Porthetria japonica.*" It was first called *Lymantria dispar*, but was afterward changed.

I still believe that the Ichneumon Fly found here will destroy the *Ocneria dispar*. It will require demonstration to prove the contrary, as their food and habits are identical as far as I can learn. It is the destructive power of this Microgaster that prevents the moth from being a formidable scourge in Japan. It is really wonderful how effectively it works. On this account the moths and caterpillars are constantly diminished.

I send you the freshest specimens of cocoons that I could find. I am sorry that they have proved unproductive.—[H. Loomis, Japan, September 1, 1892.

REPLY.—There can be no doubt as to the specific distinctness of *Ocneria japonica* and *O. dispar*. What you state as to the size and variation of larva are well-known entomological facts. The other points of difference are more important, however. Both sexes of *japonica* average a third larger than *dispar*. The coloration is more suffused and the markings are less distinct. The cross bands in the front wings of the female are nearly absent in *japonica*, while the male lacks entirely the differentiations of color into brown and fawn, and here, too, the transverse bands are indistinct or wanting. The generic names which have been previously used for this form, viz, Porthetria and Lymantria, have no particular significance, as they indicate simply the opinions of certain authors as to the generic position of the insect. Generic names are constantly changing. You are doubtless correct, however, in believing that the two species are so closely related that the Apanteles which you have found will prey upon both.—[September 29, 1892].

Injurious Insects in Nebraska: Season 1892.

Some insects have appeared in more injurious numbers than heretofore, while others have been very inconspicuous. The Apple-tree Tent-caterpillar was more plentiful than last season, as was also the Yellow-necked Apple-tree Caterpillar (*Datana ministra*), the latter more injurious than for some years past. The Codling Moth was not able to do any damage of note, as the apple crop is an entire failure. Some think that will have the effect of checking the ravages of this moth on the next crop. The Walnut Caterpillar (*Datana angusii*) made its first appearance July 22 and did the usual amount of damage. The Willow Saw-fly (*Cimbex americana*) was present, but in greatly diminished numbers. The larvæ and beetles of the May Beetles (*Lachnosterna* spp.) were very numerous, but did not do as much damage as in the previous year to corn. The Corn Root-worm (*Diabrotica longicornis*) was not so numerous as last year, although the mature beetles seemed much more numerous. Have not heard any serious complaints of the worm doing damage to corn. The Chinch Bug was present in some localities, but did comparatively little damage. The Green-striped Maple-worm was far worse than for some years past, completely defoliating trees in many places. The larvæ of the Sphingids, or hawk moths, were very abundant during the first part of July and were quite injurious to tomatoes later in the season. The Green Cabbage-worm is very numerous, completely destroying all late cabbages, making the crop very scarce. This worm has been increasing in numbers each year.—[William N. Hunter, Nebraska, October 20, 1892.

House Ants of Mexico.

House ants, or, as they are called, *Hormiga asqueles,* are the house scavengers. They make occasional visits to the buildings to eat the insects that bore into the wood. Previous to one of these visits the furniture of a room will be strewn with particles that fall from the ceiling above; after one of the periodical visits for some time that ceases.

While stopping at the Hotel Bola de Oro at Tepic, suddenly one afternoon late these insects came in countless numbers. They assailed the dining room so that supper had to be taken outdoors. Next morning my room was covered with them; they swarmed over the roof, the walls, floor, and into every sheet of paper with or without botanical specimens. For two days they were masters of the situation. If I sat down to change dryers or whatever else, they swarmed over me to so great an extent, biting so furiously, that I quit the room. The second day they disappeared to overhaul the rest of the building.

For fear they might make lodgment among the botanical specimens I instituted search, and found among the dried plants of one sheet the ants that are in the accompanying bottle. They were all dead. What produced death I can not say.—[Edward Palmer, Tepic, Mexico.

NOTE.—The specimens which accompanied this communication belonged to a new species of the genus Eciton not represented in the National Collection, and which can not be determined by any of the works on Formicidæ in Washington.

The Stony Acorn Gall.

You have described a gall or galls on acorns—did you ever find any in the nut? I came across two examples last autumn in which the cotyledons were pitted with the small cells of some Cynipid, but in spite of all care I failed to get the flies. I inclose parts of the infested nuts.—[Mary E. Murtfeldt, Missouri, September 17, 1892.

REPLY.—This gall in acorns has been known for a good many years, original specimens having been received by Dr. Riley from Thomas Meehan in 1872. Later Mr. H. G. Hubbard found it at Detroit, Mich., in 1875, and what is probably the same thing was recently received from Mr. Koebele at Alameda, Cal. The species has not been described, although a few of the flies have been obtained. They bear his manuscript name of *Callirhytes fruticola* in the collection. It is peculiar in the fact that the entire interior of the acorn is filled with the Cynipid cells, the walls of which are extremely hard.—[September 29, 1892].

Destructive Appearance of the Roller Worm.

Can you give me any information on what are called roll worms? The moth seems to lay the eggs on the under side of the leaves of all kinds of beans, which hatch into a worm that rolls the leaf around itself. They are very destructive, especially to all members of the bean family. If you know of any method of checking them I shall be deeply obliged to learn of it.—[C. G. Philips, Dade County, Fla., September 19, 1892.

REPLY.—* * * The "Roller worm" which you mentioned is the larva of a common butterfly known as *Eudamus proteus.* In spite of the fact that the caterpillars feed in the folded leaf the majority may be killed with Paris green or London purple applied in the proportion of one-fourth pound of the poison to fifty gallons of water. In a small garden, however, the best plan is to go through with a pair of shears clipping through the middle of each leaf roll and thus destroying the larva. In the Annual Report of this Department for 1879 will be found an account of this insect on pages 269, 270. It is also injurious to turnips and cabbages.—[October 1, 1892.]

Swarming of the Archippus Butterfly.

October 5, I saw a rare occurrence, swarming or migration of the Archippus. On the 4th I made a trip some four miles east of here to see a case of Texas Fever, in company with Dr. M. Francis, Veterinarian of Texas Station, and along a "Draw" where Red-bud, Persimmon, etc., were thick, I found hundreds of these butterflies "roosting" at 3 P. M. They were as thick as the leaves on the shrubs, and often I could catch six or eight at one sweep of my 18-inch net.

October 5, at 8 A. M., they began swarming, and at 9 the air, as far as one could see east and west, from 40 to 200 feet above the ground, the butterflies were flying to the south, apparently one every few feet; often a cloud of several hundred would pass, almost in a solid body, enough to cast a shadow. At 2 P. M. they diminished in numbers and flew lower down. From the best information I can get this swarm extended 20 miles east and west and were in motion steadily southward from 8 A. M. to 3 P. M.

October 6, a smaller swarm was seen from 10 to 3 P. M., but diminished in numbers. I thought this worthy of record as no one here recollected seeing such a migration before.—[Dr. J. C. Neal, Oklahoma.

An Anthicid Beetle reported as injurious to Fruit.

I found some specimens of a gray beetle which is doing some damage to our fruit crops in the spring of the year, about April. They first make their appearance on peach trees, the tender leaves of which they appear to eat. In May they are plentiful on cherries and later on on apricots, peaches, nectarines, plums, prunes, etc., even on early apples. Quinces are the only fruit they refuse. The damage, however, is principally to cherries and apricots. As late in the year as this I find them on peaches. They follow birds that have partly eaten the fruit, when they eat to the pits of fruit where they hide. When the fruit is handled they leave it at once, so they are seldom seen on fruit outside of the orchard. I believe the beetle is a native here. The damage by them so far is small, and I do not think they ever become troublesome, yet it is well to watch them. I have never seen them fly.—[John J. Jones, Los Angeles County, Cal., September, 1892.

Reply.— * * * The insect in question is known scientifically as *Notoxus calcaratus*. It is a member of the Coleopterous family Anthicidæ, none of which, so far as is known, are ever injurious. The habit which you have observed is interesting but is probably exceptional, as none of our eastern species of Notoxus have been reported as affecting vegetation. One of our common species occurs in the South on the flowers of cotton and doubtless feeds on the pollen. You are right in your conclusion that these insects are not the primary cause of the damage. Many species of insects, particularly beetles, which do not normally attack fruit are often sent to this Department with the report that they are injurious, but investigation usually proves that they follow the attacks of other insects, or, as in your case, of birds, being attracted by the flowing juices upon which they largely feed. Among the most common beetles having similar habits may be mentioned different species of Euphoria, Allorhina and Ips. These also feed upon flowing sap. Your statement that the Notoxus appears to eat the tender leaves of peach requires verification and we shall be greatly obliged if you will report further observations.—[October 8, 1892.]

Injury to Hammer-handles.

In my business I handle a great many hardwood handles for hammers, axes, etc., and I find that I lose a great many annually from the ravages of a little insect or wood-borer, which thoroughly honeycombs a handle in a very short space of time, leaving the handle a mere shell with innumerable small holes on the outside, and grinding the inside into a powder as fine as flour. I have found it a very difficult

matter to find specimens of this insect—the few that we have examined with a magnifying glass are smaller than a flea, and of a milk-white color with long antennæ, although one was discovered considerably larger, about the size of a flea, and dark colored, but was the only one. I would like to ask you: (1) The scientific name and common name of the insect. (2) A remedy, if there is any, to prevent the destructive work of this little pest.—[C. Ducomman, Los Angeles County, Cal., September 7, 1892, to Editor "Scientific American."]

Reply.—(1) There are several Coleopterous insects of the family Ptinidæ known to infest dry hard wood that is used for handles of various implements. Since Mr. Ducomman does not send any specimens, it is impossible to name the particular species which does the damage. It is, however, in all probability, one of the Powder-post beetles, genus *Lyctus*, of which *L. striatus* and *L. parallelopipedus* have been observed under conditions similar to those described by Mr. Ducomman. They are small, elongate, brownish beetles, and their larvæ small, six-legged yellowish-white grubs, with their bodies always curved near the tail end.

(2) The beetles and their larvæ may be destroyed by immersing the infested handles in kerosene for a short time. It is quite important, however, to thoroughly disinfect in this manner all handles which show the least trace of the presence of the beetle. The entire stock of handles kept in the store should be carefully inspected from time to time. The presence of the beetles may be easily detected from the small circular holes through which the beetles have entered the wood, or from the little heaps of fine saw-dust which accumulate beneath the infested handles.

[The above correspondence has also been published in the *Scientific American* of October 1, 1892.]

On Remedies for the "Cigarette Beetle."

As yet we are unable to estimate the damage done by the "Cigarette Beetle" *Lasioderma serricorne*, but we are now making a test by having placed 36 cases which are infested with them into cold storage, but the time is short to decide whether this process will kill them. You advise us to keep the windows closed at night; we notice that in cool weather they become rather stiff and are unable to move, but just as soon as it gets a little warmer they become more active. As our nights are rather cold at present might it not be well for us to leave our windows open at night? Can you give us any idea as to how these insects get into our place or whether they originated in our house. We at first discovered them in a lot of fine cuts.—[Hettermann Bros., Kentucky, October 7, 1892.

Reply.—* * * In view of the cool nights at the present time it may be as well to do as you suggest and leave your windows open at night. It will become necessary, however, to take strenuous methods in case you wish to rid your establishments of the insects. The tobacco which is worst infested should be burned or submitted to the fumes of bisulphide of carbon or thoroughly steamed, the latter probably being the easiest method to adopt. The insects will be much more easily killed by a very high temperature than by a very low one and the success of your cold storage experiment is open to some doubt. The Entomologist would be very glad to be informed, however, as to how it turns out. The insects could not have "originated" in your house, but must have been brought in in one stage or another with tobacco or perhaps have flown in in the beetle stage from some neighboring establishment. They are not absolutely confined to tobacco for food, but are found also in pepper, spices, and other pungent substances. They may have come to you from some drug store or from some large grocery establishment, perhaps, should there be such in your immediate neighborhood. It is more likely, however, that they were brought in with tobacco.—[October 12, 1892.]

Correspondence on the Mosquito Remedy.

An article in INSECT LIFE written by you on the prevention of mosquitoes has much interested me. I supposed the plan mentioned by you was original with me, as I had never seen it proposed before it occurred to me. It appears quite possible to me to treat large tracts of land in the manner you have tried on a small scale.

Although I have not given the subject proper scientific study, I have observed enough to learn that mosquitoes will only breed where there are rather small-sized pools of water that is not agitated and is warmed by the sun. Such pools are found in the salt marshes along the coast. In many places they are, without doubt, too numerous to make any attempt to destroy their contents successful, but in a large number of tracts of salt meadow land there are comparatively few collections of water, and here, it seems to me, the petroleum or other insecticide could be effectively applied. By careful study and experiment the smallest quantity of the insecticide could be found and the exact time that it would remain operative. Even, suppose this quantity should amount to large proportions and should cost a good deal of money, the advantage gained would be so great that the plan could be carried out. To free a mosquito-infested district from the pest, in many parts of the country, would increase values of lands thousands, perhaps millions of dollars, and land-owners would gladly pay for it. I myself am an owner of land along the Sound and I would be most happy to add my share to a fund to relieve us from the pest.

Could the plan of ridding a district from mosquitoes be shown to be feasible by some authority on entomology I think an association could be formed to carry it out. Please inform me whether it is within the province of your Department to assist in such an undertaking. If not, perhaps INSECT LIFE might agitate the subject and awaken sufficient interest in the matter to have means provided to test the mosquito destroying plan.—[Dr. Wooster Beach, New York, N. Y., October 14, 1892, to L. O. Howard.

REPLY.—* * * I do not claim to have originated the plan of treating breeding pools with kerosene as a remedy against mosquitoes, but it is a remedy which has been floating around in the air for the past twenty years if not longer. I began studying entomology in 1866, and it seems to me that I have always been familiar with the suggestion. It has been published, however, very rarely, and no accounts of accurate experiments have ever been put in print so far as I know, except the one of mine which you are kind enough to compliment. I fully believe that in many localities the remedy will pay and that, as you suggest, there is room for further experiment, although it seems to me that I have effectually proved the efficiency and economy of the plan. I have shown that one barrel of kerosene will treat 96,000 square feet of water surface and that the effect of this treatment will last longer than ten days, even if rain storms intervene. Calculate for yourself on the basis of the 370 mosquitoes my little experiment killed. All were females. Suppose each female to have laid 200 eggs. Barring accidents, in twenty days there would have been from those 370 mosquitoes seventy-four thousand individuals. One-half of these being females and each laying 200 eggs, in six weeks from the time of my experiment there would have been seven million four hundred thousand mosquitoes! Such figures as these are to a certain extent defective, but they indicate possibilities and they give at least a faint idea of what can be done by work of this kind *early in the season*. It is within the province of this Division to undertake experiments of this character, and I think it quite likely that further experiments will be made next season. * * * I can assure you that if I had the misfortune to live in a mosquito-ridden neighborhood I should agitate the matter among my property-holding neighbors and I think it would not be difficult to arouse such a public sentiment that active remedial work would be undertaken.—[L. O. H., October 15, 1892.]

Note on the Drone Fly.

I send a cage of insects which made their advent in our greenhouse with the blooming of *Farfugium grande* in the economy of which flower they are apparently in some manner concerned. They act like bees, and greatly resemble them not only in the busy way in which they work among the flowers, but in the way they fly, and carry their hind legs—imitating the pollen-freighted limbs of the bee. All whose attention I have called to them, or to whom I have shown the insects mistake them for Honey Bees. I find, however, they have no sting, and have the head and proboscis of a fly. They evidently fulfill the same office with relation to the composite above-mentioned as the Honey Bee, of which they are such a good imitation. * * *—[Ernest Walker, Indiana, October 27, 1892.]

REPLY.—The insect is a true fly known as the Drone Fly, *Eristalis tenax*. The larva of this insect is one of the rat-tailed maggots, so called for the reason that the anal segments of the body are attenuated and telescopic, the spiracles being situated at the tip, thus enabling the larva to breathe while its body is embedded in liquid filth. The adult fly is frequently found in greenhouses, and is supposed to be a valuable aid in the fertilization of chrysanthemums and several other plants. Its resemblance to the Honey Bee is common to other members of the Dipterous family Syrphidæ, as well as the family Bombyliidæ.—[October 31, 1892.]

[illegible] 1893a

Another irregular Appearance of the Periodical Cicada.

During last June the Periodical Cicada was quite common here; in an oak grove on my place I could sometimes hear four or five singing at once. I captured several imagos and found a number of pupa cases attached to leaves and twigs.

I thought it was unusual to find them in such numbers four years after their regular visit. The last regular year was 1888. I would have sent the above sooner, but although it was interesting to me I did not know it would be worth sending, till I read your note in last INSECT LIFE (p. 50).—[H. J. Giddings, Iowa, October 6, 1892.

REPLY.—The instance which you mention is very interesting if true, but your explanation that these Cicadas are laggards from brood V (1888) is probably incorrect. It is much more likely that they are the precursors of Brood XI, which will appear in parts of North Carolina, Virginia, Maryland, Indiana, Illinois, and Colorado next year (1893). Your locality will be a new one for the brood, and we shall be glad to be notified next year in case you see any specimens. In 1876 this brood was not observed even in Illinois, but in 1842 and 1859 it was seen near Alton.—[October 10, 1892.]

The New York Pear-tree Psylla.

* * * Will you please give me the reference to Foerster's description of *Psylla pyricola?* Are you quite sure of the reference of our Hudson River species to *pyricola?* The front wings are not as Loew describes them, "without any markings whatever," but are distinctly marked with the spots in basal cell shown in the figure given by Thomas in the Eighth Illinois Report, p. 13, and less plainly on the hinder wings. I have an example in which the wings are without markings, but unfortunately with no date or locality.—[Dr. J. A. Lintner, New York, October 24, 1892.

REPLY.—* * * The common Pear-tree Psylla of Massachusetts and New York is unquestionably *P. pyricola* Foerst., and agrees perfectly with European specimens sent me by Dr. Loew. It was originally described by Foerster in "Uebersicht der Gattungen und Arten in der Familie der Psylloden," Verhandl. d. naturh. Vereines d. preuss. Rheinlande, 1848, Vol. V., p. 77. This citation is taken from Loew's "Revision der paläarktischen Psylloden" since our only copy of Foerster's paper has been mislaid. The blackish spot in the clavus and posterior basal cell of the front wing

of *P. pyricola* is particularly mentioned by Loew (see translation in INSECT LIFE, vol. IV, p. 127, line 6 from bottom). The color of the wing described (l. c., p. 128) refers to the disc of the wing in comparison with *P. pyri.*

There occurs, however, another imported Pear-tree Psylla in your State, viz: *Psylla simulans* Foerst., which is somewhat larger than *P. pyricola* and has indefinite dusky spots on the forewings between the radius and the veins composing the cubitus; but we agree with Slingerland that this is but the hibernating form of *pyricola.*—[October 29, 1892.]

A Tropical Cockroach in a New Orleans Greenhouse.

We send you by this mail insects received from a correspondent at New Orleans. Will you identify them for us, and suggest some means of destroying them? They are destructive to palms and ferns, eating out the heart. They attack the large Alsophilas with avidity.—[American Florist Company, Chicago, Ill., October 5, 1892.

REPLY.—The insect which you send is a cockroach which has been apparently imported from the West Indies into New Orleans, as it is not known to occur normally in this country. It is known scientifically as *Panchlora surinamensis*. It will pay your correspondent to make every effort to stamp the species out in his greenhouse, either by means of an arsenical spray or by the free use of California Buhach.—[October 12, 1892.]

Remedies for White Ants in Fruit Trees.

I send a root, a section of the body, and some branches of an apple tree that died lately, without any apparent cause; also some branches of a cherry tree. You will observe that this apple tree has been broken off about eight inches below the surface of the ground and near the root. We are not aware that it has met with any accident, and the break must have been the result of some disease which weakened the fiber.—[G. O. Shields, New Mexico, November 1, 1892.

REPLY.—An examination of the sections of apple tree shows that it has been damaged by Termites or White Ants, and probably by the species known as *Termes flavipes*. Nests and colonies of these insects are ordinarily found in deeply-buried decaying roots, or in the hearts of stumps and logs of large size. They extend their operations to very great distances, excavating underground tunnels. Growing wood is not the natural food of the insects and is only attacked by them under exceptional circumstances. Recently transplanted trees whose roots have suffered mutilation, or those which have been planted too deep, or which have too much earth heaped around the crown, are subject to much damage by Termites, but old and well established trees are not greatly liable to their attacks, except through disease or other injuries by which dead and unhealthy wood is produced. The principal precautions to be taken against these insects are to remove all decaying wood from the orchards; to avoid mulches, except where necessary for other reasons, leaving the crown of the tree exposed to the air, and avoid deep planting. As to remedies, when the decay is discovered early enough, it will be well to remove the earth about the crown and principal roots, cutting away all dead wood and bark and pouring on hot water. A dilute kerosene emulsion, applied as to grapes, will also destroy all insects which may be present. Young trees of some varieties which have been completely girdled may be saved, if taken in time, by inarching scions between the root below and the stock above, thus reëstablishing the connection between the two. The tree will in time restore the eroded bark, and the scions may be allowed to remain or may be afterwards cut out. A poultice of mud and cow-dung applied to the injured part will protect it and materially assist in the formation of new wood and bark. In place of the inarching scions, young cuttings may be planted close to the base of the tree and subsequently their tops may be grafted into the trunk.—[November 10, 1892.]

A Swarm of Spring-tails.

The inclosed insects were found in the public road, and were dipped up into the bottle just as we send them to you. When turned loose they jump from 3 to 5 or 6 inches. At first I thought they had wings, but looking at them through the microscope I find no wings, and I can not see any extra legs for jumping. They were in the road in vast numbers, several quarts of them, creating the impression that some one had lost a quantity of gunpowder. * * *—[J. S. Wilson, South Carolina, October 20, 1892.

REPLY.—The insect which you found in pools of water by the roadside is one of the "spring-tails" known scientifically as *Achorutes armatus*. It is closely related to the so-called "snow flea" (*Achorutes nivicola*), a species which occurs frequently upon the surface of snow in great numbers in the winter time. The insect jumps not by the aid of its legs, as you seem to suppose, but by means of a spring under the abdomen. These creatures are not injurious to living plants, but feed upon dead and decaying vegetation.—[October 25, 1892.]

Tame spiders.

I send specimens of a very handsome spider, with "cocoon" containing eggs. These spiders spin a funnel-shaped web, behind which they remain concealed until some unwary insect enters, when they spring out. They are very handsome, with their striped legs and reddish body spotted with white. This one is very tame. For months it has lived over the head of my bed, allowing me to examine it. When it began to get uneasy I placed it in a box, where it spun a beautiful covering for its eggs. I am very partial to spiders, and never destroy one nor its web unless I am compelled to do so. In my own room I let them have full sway. There are probably fifty spiders there now and they never molest me. I find them all over the bed clothes. I believe the stories of their poisonous bites to be largely exaggerated. We have here those large, black spiders mentioned by John March in INSECT LIFE for August, 1892 (vol. IV, p. 398). I found one of them curled up under my baby's neck one morning. This one did not attempt to fight, but if prodded with a stick they will fight back.—[Mrs. M. E. Rice, Pennsylvania, October 15, 1892.

NOTE.—The spider sent is *Epeira trifolium* Hentz.

NOTES FROM CORRESPONDENTS.

A new Bark-louse on Orange.—We have received from Mr. Coquillett, Los Angeles, Cal., specimens of a new species of the genus Pseudococcus, which was found upon Orange at Riverside, Cal., by Dr. Claflin. The same gentleman also found specimens of this same insect both above and below ground on *Solanum douglasi* growing in the vicinity of the orange tree upon which the other specimens were found. As soon as we succeed in getting a good series illustrating all stages we may describe the species.

Damage to Cigars in Brazil and the West Indies.—Mr. Herbert H. Smith, who has spent many years in collecting in South America and Mexico, informs us that some insect does a vast amount of damage to cigars in Brazil and the West Indies. Having never seen the insect he is unable to identify the species, but states that it bores into the cigars, riddling them with holes of about the diameter of a No. 3 Kläger pin.

This insect is in all probability *Lasioderma serricorne*, the so-called "Cigarette Beetle," a cosmopolitan species of miscellaneous food-habits, but best known as a pest

in tobacco warehouses. References have been made to this insect in INSECT LIFE, volume I, pp. 357 and 358, and volume II, pp. 368–9.

Dark-colored Cattle most subject to Horn Fly Attack.—Apropos of the subject of the color of a host and its relation to parasitism or insect attack, which was discussed on page 265 of the last volume of INSECT LIFE (volume IV), it may be of interest to state that one of our correspondents, Mr. H. B. Paxton, of Lake County, Fla., asserts that the Horn Fly appears to show a preference for dark-colored, dark brindle, or black cattle. This is a direct contradiction to the statement of Prof. Wallace in his work on Darwinism. In preceding pages of the current number it will be noticed that Mr. H. E. Weed, entomologist of the Mississippi Experiment Station, made a similar statement before the last meeting of the Association of Economic Entomologists. We might repeat here Mr. Howard's assertion referred to in volume IV (pp. 205) that there is no connection between the color of cattle and the Horn Fly.

Scale-insects not poisonous.—Some time ago Prof. E. R. Lake, of the Washington State Agricultural College, wrote us that the inspector of fruit pests for that State asserts that the use of fruit affected with San José scale is injurious to the human system. He states that certain physicians have had cases to treat wherein children have evidently been poisoned by the use of fruit affected by this insect. The idea of any scale-insect being poisonous is a novel one, though there is no innate improbability of its being the case.

A Beetle destroying Smuts in Herbarium.—Prof. G. F. Atkinson sent us, before leaving the Institute of Technology, Auburn, Ala., specimens of a beetle which he found destroying the smuts preserved in the herbarium of the Institute. The beetle proved to be *Lathridius filiformis*, Gyllh.

Junonia cænia on Block Island.—Prof. W. W. Bailey, of Brown University, informs us that among other Lepidoptera collected by his son upon Block Island the past summer were specimens of *Junonia cœnia*, which were confined to a very limited district about the Great Salt Pond.

The Saddle-back on Helianthus.—Mr. W. J. Morrison, of New York City, informs us that he found on September 7 a colony of the Saddle-back Caterpillar (*Empretia stimulea*) on the foliage of *Helianthus globosus* var. *fistulosus*. Although the larva of this moth is known to feed on quite a variety of plants it has not hitherto been recorded on this species to our knowlege.

Damage to Cocoa in Trinidad.—We have received from Mr. J. H. Hart, of the Royal Botanic Gardens at Trinidad, specimens of a leaf-hopper with the information that it is attacking the Chocolate Plant (*Theobroma cacao*) on that island. This insect is a handsome species of the family Membracidæ, belonging probably to the genus Horicola.

"June Bugs" making Mischief in California Nurseries.—San Diego County, Cal., is reported to be afflicted with "June Bugs." Mr. W. Chappelow, of Monrovia, Cal., writes that whole orchards of young trees have been defoliated by them the past season, The insect is not known in his own neighborhood, and as no specimens of the insect doing the mischief have yet reached us we are unable to identify the pest.

Orange Scale-insects in Bermuda.—We have received from Mr. F. L. McIlvane, of Hamilton, Bermuda, branches of orange and lime trees infested indiscriminately by *Aspidiotus citricola* and *Chionaspis citri*. The interesting point about this sending is that while *A. citricola* is the most injurious scale-insect of the orange in Florida, it is rare in Louisiana, while with *Chionaspis citri* the case is exactly reversed, since this species abounds in Louisiana and is scarce in Florida. Here in Bermuda, however, we have a common meeting ground of the two species, and it is likely that in the West Indies we have the original home of each.

On the Habits of the "Variegated Cone-nose."—Regarding the habits of *Conorhinus variegatus*, Mr. J. N. Forbes, of Washington County, Fla., writes that they

frequently fly into houses late in winter and in early spring, but are seldom seen after June. During this season they pay almost nightly visits to such households as are not protected by screens. When splitting fire-wood they are often found collected by the dozen in hollow places in the wood. He has observed them with snouts buried in the leaf stems of sweet potato and grapes. Spraying with London purple produced good results.

New Food-plant for Sphingicampa bicolor.—Mr. George H. Berry, of Cedar Rapids, Iowa, informs us that he has found the larva of this Ceratocampid moth feeding in numbers upon the Kentucky Coffee Tree (*Gymnocladus canadensis*). The species is recorded only upon Gleditschia.

The Horn Fly in Oklahoma.—Dr. J. C. Neal, Director of the Agricultural Experiment Station, Stillwater, Okla., notifies us, under date of October 8, that the Horn Fly made its appearance in that vicinity about September 1 of the present year.

Another "Weeping Tree."—Dr. Neal also informs us in the communication above mentioned that two "raining trees" have recently been found on the bank of a little stream near Stillwater. One is a large Cottonwood and the other a Box-elder. A constant shower fell all day, showing plainly in the sun light like a veritable rainfall. Dr. Neal visited the trees and captured some of the insects discharging the liquid and sent them to us. The insect was, as in many other cases, *Proconia undata* Fab.

The Leopard Moth and its European Enemies.—Mr. Herman Meeske, of Brooklyn, N. Y., has called our attention to the fact that *Zeuzera pyrina* is by no means as abundant in Europe as it has already become in the vicinity of Brooklyn, and he suggests the desirability of importing European parasites. He deprecates the unrestricted importation of living pupæ of European species by collectors, and justly says: "What would people think if an individual, for his own pleasure, should import the cholera germ?"

Injury to Sorghum Tips.—An Arkansas correspondent, Mr. W. C. Brass, has mailed us, under date October 17, specimens of sorghum tips badly damaged by a long-horned grasshopper, *Orchelimum glabberimum*, which has the habit of puncturing pithy stalks of different plants for the purpose of laying its eggs. A ready remedy for this insect will be found in burning infested canes with the eggs contained in them.

GENERAL NOTES.

FIRST LARVAL STAGE OF THE PEA WEEVIL.

Under this caption we published, upon page 392 of volume IV, a short account of the eggs and first larva of *Bruchus pisi*, comparing them with those of the Bean Weevil treated upon page 301 of the same volume. The figure prepared to accompany this note on page 392 was inadvertently omitted and is given herewith. It indicates well the shortness of the postembryonic legs as compared with those of the Bean Weevil and the differences in the peculiar spinous processes of the pronotum. It also shows the mines exceptionally made by the young larva in the pod itself before entering the individual peas. It will be understood that the section of the pod shown in the upper right-hand corner of the figure is seen from the exterior, while the section shown immediately beneath it is seen from the interior of the pod.

EDWARD BURGESS'S WORK IN NATURAL SCIENCE.

Mr. Samuel H. Scudder, in the Proceedings of the Boston Society of Natural History (volume XXV, pp. 358–364), gives an appreciative account of the work which the late Edward Burgess did in natural history. Mr. Burgess was associated with Mr. Scudder in the early part of his work in entomology, and one of his first contributions was published conjointly with Mr. Scudder. Although a close student of the Diptera, Mr. Scudder shows that Mr. Burgess's best work was done in insect anatomy, and that, although familiar with many species of two-

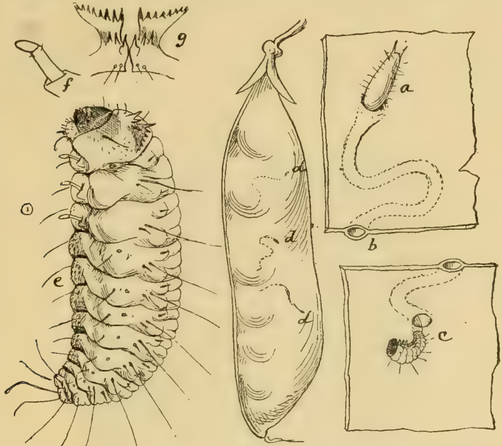


FIG. 21.—*Bruchus pisi* L., first larval stage; *a*, egg on pod; *b*, cross section of opening of mine; *c*, young larva and opening on inside of pod by which it has entered—enlarged; *d*, *d*, *d*, eggs—natural size; *e*, first larva—greatly enlarged; *f*, postembryonic leg; *g*, prothoracic spinous processes—still more enlarged (original).

winged flies, he never described but four new species. His work upon the anatomy of the Psocidæ, and particularly that upon the Milkweed Butterfly, are justly cited as models. The same may be said of the work which he did for us, in connection with Dr. C. S. Minot, on the anatomy of the Cotton Worm. When Mr. Burgess left entomology for the designing of yachts the former science lost one of its ablest American students, but the world at large undoubtedly derived more immediate benefit from his labors in the latter direction.

SWARMING OF THE ARCHIPPUS BUTTERFLY.

The swarming in the spring and fall of this large cosmopolitan butterfly has been frequently noticed and often discussed in entomological periodicals. It migrates to the north in the spring and to the south in

the fall. It seems to have been more than usually abundant this summer in many localities in this country, and as a result its migrations this autumn have been more frequently noticed than usual. In this number we publish a note from Dr. Neal, of Oklahoma, upon such an occurrence in his locality, and we have noticed in the Cleveland *Plaindealer* of September 20 a most interesting account of the passage of immense swarms over that city. The head-lines of the article are so characteristic of American journalism that they will bear repeating: "MANY MILLIONS. *Swarms of Butterflies Invaded Cleveland*, and Everybody Gazed at the Wonderful Sight—A Beautiful Vision of Orange Yellow—Strange Flight of the Insects from North to South—Mistaken for Cholera Germs—Immigrants Who Disregarded Mayor Rose's Proclamation." At the University of Minnesota these migrations have been noticed for several years by Prof. Lugger, of the Agricultural Experiment Station, and this year Prof. C. F. Nachtrieb, of

FIG. 22.—Archippus butterflies resting at night during migration period—reduced (from a photograph by Prof. C. F. Nachtrieb).

the Department of Animal Biology, succeeded in taking a good photograph of the butterflies resting at night from their long journey. The photograph was taken by means of an electric light and is here reproduced by the courtesy of Prof. Nachtrieb. A similar figure drawn in rough outlines was published by Dr. Roland Thaxter in the *Canadian Entomologist* a number of years ago.

UNUSUAL ABUNDANCE OF BUTTERFLY LARVÆ.

A gentleman residing at Falls Church, Va., brought into the office on November 5 a specimen of the caterpillar of *Papilio troilus*, one of the large, black, swallow-tail butterflies, sometimes known as the Green-clouded Swallow-tail. He said that the foreman of his farm had brought him this specimen, with the statement that, although he had never seen such a creature before, they were now present by hundreds upon the Sassafras bushes, which they were defoliating. Specimens of the foliage accompanying the caterpillar were already dry and yellow in color, and the larva itself was of a dirty yellow hue, closely approximating that of the leaves, and offering a marked contrast to its earlier bright green coloration. The date, November 5, is unusually late for this larva to be still feeding, and its abundance, as indicated by the title to this note, is also unusual.

SOME IMPORTED AUSTRALIAN PARASITES.

Mr. Koebele has recently sent us a few parasites reared in Australia from scale-insects common to Australia and California, and also a few species parasitic upon the scale-insect enemies which he has brought over to California. From several of the Coccinellid larvæ he has reared a new species of Homalotylus, and another species of the same genus on *Rhizobius ventralis*. From a larva of *Scymnus flavifrons* he sends a species of Pachyneuron which, however, is secondary. From *Rhizobius debilis* he has reared an Encyrtine, forming a new genus near Aphycus. From *Lecanium hesperidum* he sends a species of the genus Comys. From a Mealy Bug of the genus Dactylopius he sends a species of Aphycus and a species of Encyrtus, while from *Lecanium oleæ*, the common black scale, he has reared in Australia *Dilophogaster californica*, an insect which is a very effective enemy of the same scale in California. From the eggs of Icerya he sends *Ophelosia crawfordi*. From the the scale-feeding larva of *Thalpochares cocciphaga* he sends a species of Cryptus and one of Bracon. From *Aphis brassicæ* he has reared *Lipolexis rapæ* Curtis, a species which is now common to Europe, America, and Australia. He has also sent a species of Eupelmus found ovipositing upon a larva or chrysalis of a Tineid which feeds upon *Chionaspis citri*.

A NEW PARASITE OF THE RED SCALE.

We have recently received from Mr. Coquillett, of Los Angeles, four female specimens of *Aphelinus diaspidis* Howard, three of which were captured upon Orange leaves infested by *Aspidiotus aurantii*, while the fourth was found engaged in ovipositing in one of these scale insects. This is a new habit for this species which was originally described by Mr. Howard from specimens of *Diaspis rosæ* sent to the Division from Fort Read, Fla., by Col. B. F. Whitner, in 1880, and from other speci-

mens of the same scale on Blackberry collected by Mr. T. C. Chamberlin at Santa Barbara, Cal. In Bulletin No. 5 of this Division (p. 25) other specimens of this species are recorded as having been reared from a Mytilaspis upon an undetermined species of Dycaste from Japan, which we received in 1874 from the late Dr. George Thurber, of the *American Agriculturist*. The fact that this species is now found to attack the Red Scale (and we consider Mr. Coquillett's observations to indicate more than a mere probability) is interesting and important, since but one true parasite has previously been recorded from this insect, viz, the so-called *Coccophagus citrinus* Craw, which does not seem to be multiplying rapidly.

PARASITISM IN BEES OF THE GENUS STELIS.

That the Apid genus Stelis develops in the cells of the allied genus Osmia has been known for some time, but the exact nature of the parasitism, and more especially when and how the Osmia larva is destroyed by the Stelis larva, have hitherto not been explained. In a recent number of the Zoologischer Anzeiger (vol. xv, No. 383, February 1, 1892, pp. 41–43), Mr. C. Verhoeff, of Bonn, Germany, summarizes the results of a series of careful observations which throw a flood of light on the subject. The species observed are *Osmia leucomelaena* K. and *Stelis minuta* Nyl.

The species of Osmia construct cells in the interior of hollowed twigs in the manner of Megachile and similar bees. At the bottom of the cell the female Osmia first puts a layer of pollen which is to serve as food for the nearly full-grown larva. Above this pollen, the bee commences to store the cell with prepared bee-bread. At this moment the female Stelis watches her opportunity to lay an egg in the Osmia cell, the egg thus being always near the bottom (posterior end) of the food mass. Unaware of the presence of the parasite egg, the Osmia female continues her work, and, after nearly filling the cell, deposits her own egg on the top (anterior end) of the food-mass. The cell is then closed with a layer of macerated particles of plants and a second cell prepared above the first. The Stelis larva hatches but little earlier than that of the Osmia, and both larvæ feed on the food-mass, the parasite larva at the bottom, the host larva at the top. The latter remains stationary at the top and grows very slowly; the parasite larva grows more rapidly, and gradually works its way upward through the food-mass, thus gradually approaching the Osmia larva. The crisis finally comes; the Stelis larva encounters the Osmia larva—a short but deadly combat ensues—the Osmia larva is easily overpowered and killed by the much larger and stronger parasite, and its body is devoured by the latter within one or two days.

It is thus evident that Stelis furnishes another illustration of that partial parasitism which I have shown to be the rule with the Meloidæ, but differs in that the parent introduces her egg into the host cell in-

stead of placing it where the triungulin may itself seek and secure its food, or where it may cling to and be carried by the host female into her cell.—[C. V. Riley, in *Scientific American* of November 19, 1892.]

THE LARVA OF HARPALUS.

Dr. J. A. Lintner, State Entomologist of New York, has recently written us about a figure of a supposed Harpalus larva on page 97 of our Ninth Report on the Insects of Missouri. In Dr. Lintner's bulletin on "Cut-worms," page 25, he has reproduced this figure and has called it *Harpalus*, possibly *caliginosus*, whereas Saunders, in his "Fruit Insects," page 185, gives it as *H. pennsylvanicus*. We have intended for some time to publish a statement concerning this figure, and this question of Dr. Lintner's gives us the opportunity. The drawing was one of our early ones, and was originally made for Walsh (see *Amer. Ent.*, vol. I, p. 34). We used it, but always with a query as to its nature. At that time very little was known of Carabidous larvæ, but from our subsequent breeding of *H. pennsylvanicus*, and from the more recent literature, we now question whether the figure in question is that of a Harpalus larva. The antennæ and tarsi of the figure remind one of a Staphylinid larva, but the markings of the abdominal joint point toward the larva of a Pterostichus or an allied genus. At any rate, this larva has never been bred. On the other hand, our Figure 27 of the Ninth Report on the Insects of Missouri (reproduced in the First Rept. U. S. Entom. Comm., p. 290, Fig. 24), is that of Harpalus.—[C. V. R.]

DIPTEROUS LARVÆ IN THE EYE OF A TOAD.

In the "*Særtryk af Entom. Medd.* 2. B. 2. H.," Dr. Fr. Meinert publishes a most interesting article under the title of "Larvæ Luciliæ sp. in orbita Bufonis vulgaris." It seems that a toad was brought to him which had been unfortunately killed in hot water before he saw it, in the right eye of which were found seven small dipterous larvæ, while upon the back of its head were several eggs. After careful study, Dr. Meinert decided that these larvæ belonged to some species of the genus Lucilia, and was inclined to think that they hatched from the eggs observed upon the skin of the back of the head, and made their way from that point to the eye. He reviews the literature of dipterous larvæ inhabiting the Bufonidæ, and shows that the general consensus of opinion concerning cases previously observed has been that the larvæ found did not primarily attack the healthy animal, but that the eggs were laid upon injured individuals in sores and cancerous spots. The case described by himself, however, indicates that here, at least, the attack was primary. The Dipterous larvæ were killed with the toad, so that there was no opportunity to rear the adult fly.

AN INSECT TRANSMITTER OF CONTAGION.

Insects, particularly our common household species, are frequently accused of being the agencies of transmission of contagious diseases. The House Fly, Blue-bottle Fly, Mosquito, the Bed Bug, and the so-called "Yellow fever Fly" are often under suspicion, and occasional instances of suspected cases are mentioned in the daily press and in medical journals. The following, from the *Medical Record* of September 17, 1892, is interesting, if true:

Bedbugs, according to Dr. Dewèvre, may be carriers of tuberculosis contagion. His attention was called to this possibility by a case of tuberculosis occurring in a young man who slept in a bed formerly occupied by his brother, who died of the disease. The room had been thoroughly disinfected, but the bedstead had for some reason escaped this salutary process. Dr. Dewèvre observed that the young man had been bitten by the insects, and, securing some of them, found them full of tubercle bacilli. He afterward put some presumably healthy bugs in contact with tuberculous sputum, and was able to obtain from them, several weeks later, some excellent cultures of tubercle bacilli. The bugs seemed lively, however, and had no cough, night sweats, or other of the familiar clinical symptoms of the disease.

A SCALE INSECT ON THE KAROO BUSH.

The *Agricultural Journal*, of Cape Colony, in its issue of September 8, 1892, records the occurrence of a new scale insect in great numbers on a fodder plant known as the Karoo Bush, at Eland's Drift, in the southeastern province. Mr. P. Troskie, who sent specimens to the local Department of Agriculture, wrote in July that, in spite of abundant rains, the Karoo looked as though suffering from a heavy drought. The specimens were examined at Cape Town by Mr. Peringuey, who determined them as belonging to Ceroplastes, and who advised the burning of the bushes on a large scale as a palliative. The waxy covering of the insect, it is thought, will aid in this destruction by fire, while as the bushes were already dead at the time of writing they would be of no further use as fodder and would at the same time burn more readily.

THE SILK OF SPIDERS.

In the *Revue des Sciences Naturelles appliquées* for March, 1892, there is a paper by Rev. P. Camboué on the silk of spiders. After giving a history of the attempts to obtain and use the silk of spiders, he gives some interesting experiments of his own, made on a large orb-weaving spider of Madagascar, *Nephila madagascariensis* Vinson. He finds that the spider furnishes the most silk after she has laid her eggs. From one spider there was obtained in twenty-seven days nearly four thousand meters of silk. The silk was of a golden-yellow color. He gives the plan of an apparatus for winding the silk, which, however, as he says, is imperfect. Nothing, however, was done as to the raising and keeping of the spiders in large numbers, undoubtedly the most serious question.—Nathan Banks.

THE MEXICAN JIGGER OR "TLALZAHUATE."

In No. 6, vol. IV, of "*El Estudio*," the organ of the National Medical Institute of Mexico (pp. 196–99), is published an interesting article by Fernando Altamirano upon a larval Trombidium, known commonly throughout Mexico by the Aztec name "Tlalzahuate," which signifies literally "grain of earth," and which evidently closely resembles the two larval forms of this genus which we described a number of years ago as *Leptus autumnalis* and *Leptus irritans*. The pest is common in parts of Mexico and adheres to and burrows into the skin of human beings. It is reddish in color and lives upon plants, particularly upon Sedges. The author describes a somewhat serious case of injury by this mite to Sr. Rafael Rebollar, who spent eight days during October at Tamascaltepec, and who became badly infested with the mites. Upon his return to the City of Mexico his skin presented a very peculiar appearance. The pathological features of the inflammation and the subsequent ulceration are carefully described by Dr. Altamirano, together with the treatment, which was principally the application of phenic washes and iodoform powder. No trace of the insect could be seen in any of the blisters or ulcerated spots, and the question is discussed as to whether the ultimate sores were really occasioned by the "Tlalzahuates." Judging from our experience with the allied species in this country, the extreme inflammation and ulceration described in this case was probably produced partly by the violent scratching in which the patient admittedly indulged, and partly by the condition of the blood. Following Dr. Altamirano's paper is a careful description of the mite itself by Dr. Alfredo Dugès, of Guanajuato, but without the determination of the specific name of the adult Trombidium. The paper is accompanied by a full-page plate figuring the mite and its enlarged mouth-parts and tarsi.

OBITUARY.

Three entomologists of world-wide reputation have died during the past summer.

Dr. Hermann Burmeister, born January 15, 1807, died from the result of an accident at Buenos Ayres, May 2, 1892. He was the author of the well-known "Handbuch der Entomologie" and removed from Germany to South America, where he became the Director of the Museum of Natural History, Buenos Ayres, in 1861.

In June Dr. Carl A. Dohrn died at Stettin, Germany, in the 86th year of his age. Dr. Dohrn was president of the Entomological Society of Stettin for upwards of forty years and during that period was the editor of the "Stettiner Entomologischer Zeitung." His special work was in the order Coleoptera, but he was a man of wide information.

Major-General F. O. G. Quedenfeldt died recently in Berlin, at the age of 75. He was a well-known writer upon Coleoptera and was par-

ticularly well informed concerning the coleopterous fauna of Africa, nearly all of the 37 entomological articles which he has published since 1880 referring to this subject.

ENTOMOLOGICAL SOCIETY OF WASHINGTON

November 3, 1892.—Dr. George Marx presented a paper on spider's web, showing specimens of a peculiar fleecy substance which had been sent in to the National Museum from California, and which had more recently been collected in Florida in large masses after a rain storm. Some difference of opinion existed as to the nature of the substance, but after careful chemical and microscopical tests, Dr. Marx decided that it was composed of masses of threads of gossamer spiders, collected in the air by winds and thrown to the ground in rain storms. Discussed by Messrs. Riley, Stiles, Fernow, Howard, Mann, Ashmead, Marlatt, and Schwarz.

Mr. Howard then read two papers by Mr. Townsend entitled "Notes on certain Cecidomyiidous Galls on Cornus," and "Notes on some Cecidomyiidæ of the vicinity of Washington, D. C." The latter paper contained notes upon *Cecidomyia serrulatæ*, *C. chrysopsidis* and *Diplosis resinicola*. These papers were discussed by Messrs. Riley, Ashmead, Marlatt, Howard, and Schwarz.

Mr. Chittenden presented for publication a paper entitled "Biologic Notes on some Species of Scolytidæ."

Following the reading of the papers specimens were exhibited by Messrs. Schwarz and Ashmead.

December 1, 1892.—The following officers were elected:

President, C. V. Riley; vice-presidents, W. H. Ashmead and C. W. Stiles; recording secretary, C. L. Marlatt; corresponding secretary, L. O. Howard; treasurer, E. A. Schwarz; executive committee, the officers and Dr. W. H. Fox, Dr. Geo. Marx, and Mr. B. E. Fernow. Mr. Frank Benton was elected an active member.

The retiring president, Dr. C. V. Riley, delivered his annual address on the subject of "Parasitism in Insects." The address began with a definition of the term and a classification of the subject, and then treated in detail the following subdivisions: (1) The Parasites among Insects proper, by Orders; (2) Origin of Insect Parasitism; (3) Effects of the Parasitic Life; (4) Economic bearings of the subject. At the conclusion of the address, on motion of Dr. Gill, the thanks of the Society were voted to the president.

E. W. DORAN,
Recording Secretary, pro tem.

U. S. DEPARTMENT OF AGRICULTURE.

DIVISION OF ENTOMOLOGY.

PERIODICAL BULLETIN. Issued April, 1893.

Vol. V. No. 4.

INSECT LIFE.

DEVOTED TO THE ECONOMY AND LIFE-HABITS OF INSECTS, ESPECIALLY IN THEIR RELATIONS TO AGRICULTURE.

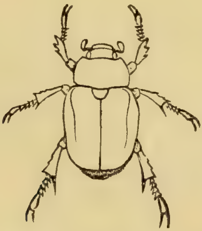
EDITED BY

C. V. RILEY, Entomologist,

AND

L. O. HOWARD, First Assistant,

WITH THE ASSISTANCE OF OTHER MEMBERS OF THE DIVISIONAL FORCE.



[PUBLISHED BY AUTHORITY OF THE SECRETARY OF AGRICULTURE.]

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1893.

CONTENTS.

SPECIAL NOTES.

The Delay in this Number.—The publication of the present number of INSECT LIFE has been unusually delayed, partly on account of the illness and absence of the Entomologist during January, and partly for other reasons. The volume will probably be completed in five numbers instead of six as in Volume IV, and will contain approximately the same amount of matter as the preceding volumes.

Bulletin 20 of the Massachusetts Experiment Station.*—In this bulletin Prof. C. H. Fernald treats of several insects which have been selected at the request of the Massachusetts Society for Promoting Agriculture, the Society appropriating funds by which the edition of the bulletin has been increased to three times its usual size. The insects are all well known pests and while they have been carefully studied at the Amherst station, the author has attempted to present brief digests of habits rather than to give anything new. He recommends legislation to compel negligent farmers to destroy the nests of the Tent-caterpillar and to provide for its destruction on public lands and forests. The insects treated are canker-worms, Apple-tree Tent-caterpillar, Fall Web-worm and the tussock moths. The tussock moths mentioned are the common White-marked (*Orgyia leucostigma*), the Willow Tussock-moth (*Orgyia definita*), and the Imported Tussock-moth (*Orgyia antiqua*). For canker-worms, banding and the Paris green treatment are recommended; for tent-caterpillars and Fall Web-worm the destruction of the eggs and tents, and for the tussock moths spraying with Paris green.

Bulletin 48 of the Cornell Experiment Station.†—In this Bulletin Mr. E. G. Lodeman discusses the efficacy of spraying apple orchards in a wet season against fungus diseases and insect pests, chiefly the Codling

* Hatch Experiment Station of the Massachusetts Agricultural College. Bulletin No. 20. Report on Insects. Amherst, Mass., January, 1893.

†Bulletin 48, Cornell University Agricultural Experiment Station. Horticultural Division. Ithaca, N. Y., December, 1892. Spraying Apple Orchards in a Wet Season. By E. G. Lodeman, Assistant in Horticulture.

Moth. With the results of the fungus treatment we will not deal, but his experiments from an entomological standpoint show that the insecticidal value of Paris green does not appear to be materially affected whether applied alone or in combination with Bordeaux mixture, while in the combination its value is greater than that of London purple similarly applied. During wet weather, applications should be made every seven to ten days, the cost of the combination spray being 7 cents per tree, or about 25 cents for four applications, this number being sufficient in even very wet seasons.

Root Knots on Fruit Trees and Vines.—The California Agricultural Experiment Station has published a little leaflet entitled Bulletin No. 99, on the subject of root knots on various fruit trees and vines. Mechanical galls, plant-louse galls, tubercle galls, club-root galls, and Nematode galls are treated briefly, and the principal portion of the leaflet is devoted to a consideration of some peculiar crown galls, usually arising from one side of the crown as a simple swelling of fleshy substance, about the consistency of a potato, or perhaps somewhat harder. Several theories accounting for the formation of these galls are discussed, and the whole question is left open. The remedy proposed is to remove and burn these galls as soon as found and make an antiseptic application to the point of removal. Bordeaux mixture is recommended for this purpose. The trees so treated should be examined from time to time, for at least a year, and the knot should be destroyed in case it reappears. All stock affected by the knot should be rejected, and great care should be taken to destroy everything showing any evidence of the disease.

The Agricultural Gazette of New South Wales.—The September (1892) number of this valuable publication has recently reached us. Mr. Olliff, the Government entomologist, announces the appearance in Australia of the San José Scale (*Aspidiotus perniciosus*) and the Greedy Scale (*Aspidiotus rapax*), hitherto known only in California. He summarizes the American remedies for these scales. A short illustrated account is given of two leaf-eating beetles which do considerable damage in vegetable gardens, the one being known as the Banded Pumpkin-beetle (*Aulacophora hilaris*) and the other as the Two-spotted Monolepta (*Monolepta rosea*). The Diamond-back Cabbage-moth (*Plutella cruciferarum*) is recorded from Tangoa, one of the New Hebrides, and the Potato Moth (*Lita solanella*) is reported as destroying Tobacco at Tamworth, New South Wales.

The Codling Moth in Australia.—The Department of Agriculture of New South Wales has published, as Entomological Bulletin No. 1, a 14-page pamphlet by Mr. A. Sidney Olliff, Government Entomologist,

on the subject of the Codling Moth. Mr. Olliff has given in a condensed form an account of the American observations on this insect, and has introduced some local matter of interest. He shows that in Sydney there are two, and probably three, annual generations. The remedies recommended are, as in this country, Paris Green, and the trap-bandage system. Reference is made to the recent use of a large number of lamp traps in orchards. Mr. Olliff's investigations, however, have failed to show that any good is accomplished by the use of lights. He states that he has had many opportunities of capturing moths at lights in orchards, and while the Codling Moth could be taken freely at dusk, on no occasion has he seen a single specimen of the pest attracted by the lamp. "Last season," he says, "Mr. P. C. L. Shepherd, who had been testing the usefulness of a lamp trap in an orchard infested by the Codling Moth, brought me the contents of his trap, and I found numbers of small Geometrina, Noctuina, and various Tortricidæ, but not a single specimen of the apple pest, and this is the result that has attended the examination of the contents of each lamp that has been submitted to me." This is quite in accordance with experience which we published over twenty years since in this country. The full-page plate accompanying the bulletin represents two sections of injured apples, some of the American natural enemies, the Codling Moth itself, and *Cacœcia postvittana*, an apple-feeding Tortricid which is sometimes mistaken for the Codling Moth.

Entomological News.—This periodical has lately made two innovations. It has begun a special economic department, edited by Prof. J. B. Smith, and no longer gives abstracts of the contents of foreign entomological journals, or of such only items as refer to American entomology. As to the former department a better choice than Prof. Smith could not have been made, though considering the large number of official publications, both State and national, more or less fully devoted to applied entomology, the demand for private publication on the subject cannot be pressing. The other innovation we regret and must view as a retrogression; for if there was one feature which made *Entomological News* unique and useful to all entomologists it was this bibliographical department. Even those who have access to the larger number of the entomological publications of the world cannot examine them all and a current statement of the contents of all in compact form is invaluable. Such a department might well be made more, rather than less complete, and would secure more subscribers than any other feature.

Kansas Injurious Insects.—A handy pamphlet of some 125 pages has just been published by the University of Kansas at Lawrence, entitled "Common Injurious Insects of Kansas," by Vernon L. Kellogg. The

matter is arranged according to the crops infested and is preceded by a short account of remedies in general and an introduction on the metamorphoses of insects. All of the principal crop pests are treated, each subject comprising the four sub-heads of Diagnosis, Description and Life-history, Remedies, and Kansas Notes. Under the latter head are given the original observations of the pamphlet. The author seems to have familiarized himself quite thoroughly with the literature and his summaries are well condensed and useful. The sixty-one figures are many of them borrowed, but about thirty are original. This is a more useful pamphlet than a similar one issued some four years ago by the Nebraska Experiment Station, largely on account of its condensation and practical arrangement, to say nothing of the evidently superior information of the author.

A New Wheat Insect in Minnesota.—In a recent bulletin of the Minnesota Agricultural Experiment Station* Mr. Otto Lugger presents a preliminary report upon a new insect injurious to Wheat, which will prove to be one of the frit flies, although the adult has not yet been reared. The insect is present in great numbers and promises great loss in 1893 unless remedial measures are undertaken. The insect hibernates in the culms in stubble fields, and Mr. Lugger advises the plowing up of all such fields. In some places during 1892 cne-fourth of the entire crop was destroyed. The species may prove to be identical with that found in Canada and Kentucky, and which has been tentatively determined by Mr. Garman as *Oscinis variabilis* Loew.

A Tasmanian Handbook of Insect Pests.—The Department of Agriculture of Tasmania has issued as its first bulletin a little work entitled "A Handbook to the Insect Pests of Farm and Orchard: Their Life History and Methods of Prevention." Part I. By Edward H. Thompson. Launceston: 1892.

The author treats especially of the desirability of a quarantine against introduced pests, gives a section upon the life history of insects, some little account of injurious fungi, and dwells at length upon the Codling Moth. The other insects treated are the Oyster-shell Bark-louse of the Apple; the Woolly Root-louse; the common Pear Slug; the Cherry Borer Moth, as Henry Edwards's *Cryptophasa unipunctata* is called; the Bud Curculio (a species of Perperus); two apple-root borers (*Leptops hopei* and *Leptops robustus*); the Pear-blight Beetle, and a few other species of less importance. A list of twenty-one remedies is given, and five appendices follow, *a*, giving a list of insect-eating birds; *b*, a sum-

---

*University of Minnesota. Agricultural Experiment Station. Bulletin No. 23, St. Anthony's Park, Minn., September, 1892.

mary of Dr. Packard's classification of insects; *c*, an account of arsenical spraying; *d*, a paragraph on a fungus disease known as Black Spot, and *e*, on spray pumps and spraying materials. The work is of handy size, and is illustrated by fair wood-cuts, original in design and execution.

Recent Bulletins of the Delaware Experiment Station.*—In Bulletin No. 14 of this Station, which has been long delayed, Prof. A. T. Neal, the Director, reports the results of some experiments with fertilizers in combating insects, in which he comes to the conclusion that nitrate of soda excels potash and phosphoric acid compounds in its powers to protect plants against cut-worms and other insects affecting young corn. Mr. M. H. Beckwith follows with a short account of *Crambus caliginosellus*, which he found feeding upon corn at the Station and which we have already referred to on page 42 of Volume IV. As this insect is one of the old Clemensian species there would seem to be little need of the technical description which Mr. Beckwith gives.

In Bulletin No. 18† Mr. Beckwith treats of the Strawberry Weevil on pages 11 to 16. This insect, it seems, has been very destructive to the strawberry crop in parts of Kent County, Delaware, during the early summer of 1892, and Mr. Beckwith has made careful observations on the life-history of the insect, his results coinciding in the main with those which have been made in the vicinity of Washington and which were given in full in the last number of INSECT LIFE.

Bulletin No. 90 of the New Jersey Experiment Station.—In this Bulletin Prof. J. B. Smith, Entomologist to the Station, treats of grasshoppers, locusts, and crickets, particularly with reference to their injury, or supposed injury, to the cranberry crop. He finds that the general idea among the cranberry growers is that the true or short-horned locusts are responsible for the peculiar and common damage to the berries themselves, which consists in eating directly into the seed from one side of the berry. Prof. Smith shows that this damage is not done by Acridiidæ but by Locustidæ, and probably by one or two species of katydids. This point he reaches by comparison of the heads and digestive systems, as well as by examinations of crop contents and actual feeding experiments. He gives original illustrations of the mouth-parts of insects of these two families, as well as of certain crickets, and also shows by photographic reproduction the inner surface of the crop of one insect of each of these families, and also of a cockroach. The re-

---

*Delaware College Agricultural Experiment Station. Bulletin No. XIV. Newark, Delaware, December, 1891.

†Bulletin No. XVIII, September, 1892.

medial measures suggested for this particular damage are to keep the bog clear of other vegetation and as wet as consistent with good culture; to keep the marginal ditch wide, clean, and at least partially filled with water, and to keep the dams clear of vegetation.

The bulletin is an excellent illustration of the value of thorough, scientific work in settling mooted questions and correcting common error. We can see no good purpose, however, in encouraging the perpetuation of popular error in this country by rejecting the term "locust" for the short-horned locusts simply because the technical family name Locustidæ has come to refer to the long-horned species; while the argument of popular use is without force when dealing with popular error, and would oblige us to call "turtles" "salamanders," and "gophers" "turtles" in some parts of the country, or perpetrate many other ridiculous local usages, some of which are indicated in the item on popular names for our commoner insects in this number of INSECT LIFE. The more recent classifications will also give Locustidæ priority for the true or short-horned locusts (Smith's "grasshoppers"); include the long-horned species or true grasshoppers in the Phasganuridæ and the tree-inhabiting katydids in the Pseudophyllidæ.

New Publications of this Division.—Bulletin No. 28, entitled "The More Destructive Locusts of America north of Mexico," by Lawrence Bruner, was issued April 8, 1893. It consists of an illustrated account of 19 species of Acridiinæ which have occurred in this country in such numbers as to attract particular notice, or which from their known habits and relationships, are liable to become injurious. Each species is fully described in all its stages, so far as these are known, and its range and particular habits are given. The bulletin will enable the ready determination of the particular species in any future locust outbreak.

Bulletin 29, also just published, gives the concluding facts in the investigation of the Cotton Boll Worm (*Heliothis armiger*) which we carried on during 1891 and 1892, mainly through our former assistant, Mr. F. W. Mally, who is the author of the report. Few new facts are brought out, but the bulletin gives the results of some accurate experiments which will be of interest, and we trust of value, to cotton-growers in the regions where this destructive insect is particularly abundant.

Changes of Address.—For the benefit of the correspondents of three of our former assistants, Messrs. F. W. Mally, A. B. Cordley, and Nathan Banks, we wish to state that none of these gentlemen are at present connected with this Division. Mr. Mally's address is East Des Moines, Iowa; Mr. Cordley's is Pinckney, Mich., and Mr. Banks's is Sea Cliff, Long Island, N. Y.

THE ORANGE ALEYRODES.

(*Aleyrodes citri* n. sp.)

Order Homoptera: Family Aleyrodidæ.

It has been our intention for some time to prepare an editorial paper on the curious little insects of this family, and we begin with what is perhaps the most important of the species in the United States. The family Aleyrodidæ is not a large one, although its species are of the greatest interest structurally and of frequent importance economically. Up to the present time less than fifty species have been described, and only four of our North American species have received names. All of the described forms have been placed in the genus Aleyrodes except

FIG. 23.—*Aleyrodes citri* Riley and Howard: *a*, orange leaf badly infested by full-grown larvæ—natural size; *b*, outline of egg; *c*, young larva in the act of hatching from egg; *d*, newly hatched larva seen from below—enlarged; *e*, leg of *d*; *f*, antenna of *d*—still more enlarged; *g*, advanced pupa; *h*, adult nearly ready to emerge and seen through pupa skin; *i*, adult with wings still unfolded in the act of emerging from pupa shell—enlarged; *j*, leg of *h*—still more enlarged (original).

three species, for which Signoret erected the genus Spondyliaspis (afterwards found to fall before Maskell's Inglina, erroneously supposed by the latter to belong to the Coccidæ), and two other species for which Mr. A. C. F. Morgan has erected the genus Aleurodicus (*Ent. Month. Mag.*, vol. XXVIII, pp. 29–33, 1892). One of the American species, Shimer's *A. asarumis*, we also find to belong to Aleurodicus.

For many years an important and interesting species of the type genus has been known to infest orange trees in Florida and in more northern greenhouses, and more recently the same form has appeared in injurious numbers in the orange groves of Louisiana. In the *Florida Dispatch*, new series, vol. XI, November, 1885, this species received the name of *Aleyrodes citri* at the hands of Mr. Ashmead. The *Florida Dispatch*, however, is a local newspaper of no scientific pretensions,

and the description accompanying the name was entirely insufficient to enable recognition aside from the food-plant. We adopt the name in connection with a full description, not with a view of encouraging such mode of publication, which is not sanctioned by the canons of nomenclature formulated and generally accepted, but as a manuscript name, satisfactory in itself, the authority to be recognized for it being comparatively immaterial.

Our first acquaintance with the species was in June, 1878, when we found it occurring in profuse abundance on the leaves of the citrus trees in the orangery of this Department. Some observations were made upon its life-history during that summer, and all of its stages were observed. During the following years we observed it in Florida and it was studied by two of our agents, Mr. H. G. Hubbard, at Crescent City, and the late Jos. Voyle, at Gainesville. The species was not treated in Mr. Hubbard's report on the insects affecting the Orange, as we wished to give it a fuller consideration than could then have been given, and other duties prevented doing so in time. Moreover, at the time when Mr. Hubbard's report was prepared the insect had not become of especial economic importance.

Since that time many further notes have been made in Washington, and we have received the species from Pass Christian, Miss., New Orleans, La., Baton Rouge, La., Raleigh, N. C., and many Florida localities, and during the past year or two it has become so multiplied in parts of Louisiana and Florida as to deserve immediate attention.

DESCRIPTIVE.

ALEYRODES CITRI n. sp. EGG (Fig. 23*b*).—Length, from 0.2 mm to 0.23 mm; with a comparatively slender petiole or foot-stalk about one-third the length of the egg proper and somewhat knobbed at base. Width about one-fourth the length, widest portion somewhat beyond the middle or at about the point where the eyes of the embryo are subsequently seen. Surface highly polished, with no sculpturing; color pale yellow with a faint greenish tinge, somewhat darker than the under surface of the orange leaf; stem very pale brownish, darker at base. Surface frequently appearing pruinose.

LARVA.—*First stage* (Fig. 23 *d*). Length when first hatched about 0.3 mm; color, pale greenish-yellow, with two large irregular darker yellow spots on the dorsum of the abdomen; all four eyes purplish-red; shape regularly elliptical; margin of body with 38 minute tubercles, each bearing a bristle of which 4 anal and 6 cephalic are specially long; abdominal segments well separated and especially visible ventrally; cephalo-thoracic and thoracic articulations invisible. Antennæ 3- or 4-jointed; basal joint short and stout; joint 2 somewhat longer than joint 1 but narrower; joint 3 four times as long as joint 2 and about one-half as wide; joint 4 one-half as long as 3 and of equal width, the articulation between 3 and 4 very difficult to define and frequently invisible. Legs very short and stout; tarsi with three crotchets and a flat disc at tip. Rostrum apparently ex-articulate, the extensile portion reaching beyond hind coxæ. Anal orifice semicircular in shape and bounded posteriorly by a slight chitinous thickening of the integument. *Second stage*. Broadly ovate, flat; color immediately after the molt almost white with an irregular longitudinal greenish-yellow spot on side of dorsal line, covering joints 4 to 7 of the abdomen, and a faint greenish-yellow spot near anterior outer angle of prothorax; eyes small, more distinct than in first stage, purplish in color. Entire dorsum densely rugose; tubercles of the margin absent except two on head and four at the anal end of the body. A

distinct slit is visible dorsally from the anal opening to the hind margin of the body; projecting from the anal opening is a conical truncate organ bearing a central papilla. Legs extremely short and stout, almost rudimentary and difficult to distinguish. Antennæ in this stage have not been made out. *Third stage.* Almost precisely resembles second stage except from its greater size. No sex distinction yet noticeable. *Fourth stage.* Length about 1.4^{mm}, width, 1^{mm}. Quite similar to third stage, but all marginal tubercles and bristles are lost except a minute bristle on each side some distance anterior to the terminal cleft. Dorsal surface densely rugulose, with numerous fine and granulate striæ, becoming more distinct toward the margin, giving this almost the appearance of being serrate. Shape broadly oval, flat, with a slight median longitudinal carina crossed by 12 short transverse ridges indicating the segments. Color, pale green, almost translucent, and resembling so closely the appearance of a leaf that the insect is extremely difficult to detect with the naked eye. Dividing line between head and thorax, with transverse dorsal ridges and

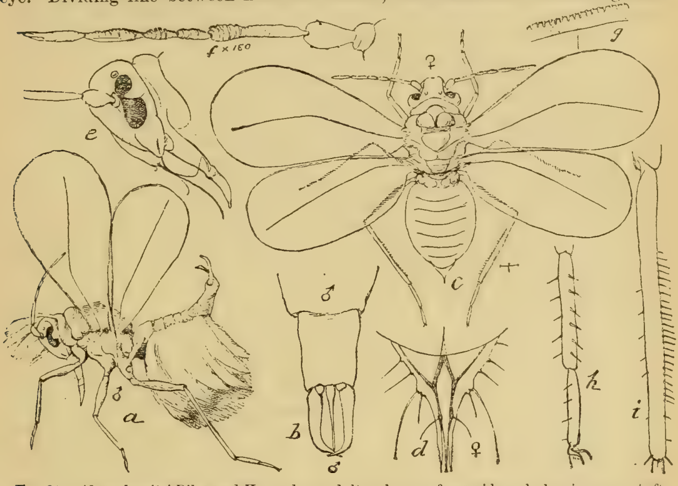


FIG. 24.—*Aleyrodes citri* Riley and Howard: *a*, adult male seen from side and showing waxy tufts, *b*, anal segments and claspers of same seen from above; *c*, adult female seen from above, with wings spread; *d*, anal segment and ovipositor of the same; *e*, head of same from side; *f*, antenna of same; *g*, costal border of fore-wing; *h*, hind tarsus; *i*, hind tibia; *a* and *c* enlarged, *b*, *d*, *e*, *f*, *g*, *h*, *i* still more enlarged (original).

margins of the anal cleft sometimes pale yellowish, with the anal opening more or less distinctly orange; eyes invisible; legs and antennæ short and stout, the latter appearing inarticulate; tarsi terminating in a large sucking disk.

PUPA (Fig. 23 *g*).—Length, when fully mature, 1.4^{mm}, transverse diameter, 0.8^{mm} to 1^{mm}; broadly oval; color, pale greenish-yellow, becoming more yellowish when maturing; thoracic lobes and spaces between dorsal carinæ of abdomen of a brighter green; a distinct orange or sometimes quite bright red medio-dorsal spot at anterior end of abdomen; anal ring, brown; eyes, purplish. A low medio-dorsal ridge or carina and corresponding depressions each side of it extends from the head to the anal ring, traversed by short transverse ridges on the thorax and on the abdomen, terminating in a low subdorsal ridge; from these ridges numerous very fine granulated striæ radiate all around the body to the lateral margin; a short transverse ridge near posterior margin of head and a curved impressed line in front of it. A minute brown tubercle at the anterior end of the subdorsal carina. From a pore at the edge of the body, between the head and thorax and tip of anal slit, issues a very

fine glistening white curled thread of excretion. Legs and antennæ of the pupa can not be made out, but after the imago has left the shell they are quite readily traced in the exuvium. Antennæ short and stout, apparently 3-jointed, though the divisions are much obliterated; the last joint longest, almost as long as the other two combined, with quite a number of irregular annulations; tip provided with a stout spine. Antennæ folded backward covering almost completely the anterior pair of legs, which are projected forward. Legs short and very stout, especially the two posterior pairs. There is scarcely an indication of a division between the different joints. Tarsus very short, stout, and rounded, with quite a long claw at tip. Anal opening dorsal, semicircular, and protected by four slender, forward-directed hairs.

IMAGO, ♀ (Fig. 24 *c*).—Length, 1.4^{mm}; expanse, 2.8^{mm}; four-jointed rostrum about as stout as legs; joint 1 shortest, joint 2 longest, and about as long as 3 and 4 together; joint 3 somewhat longer than joint 1 and a little shorter than 4. Joint 1 of the 7-jointed antennæ very short, as broad as long, subcylindrical, slightly wider distally; joint 2 twice as long as 1, strongly clavate, and at tip somewhat broader than 1, bearing 3 or 4 short hairs arising from small tubercles; joint 3 longest, about twice as long as 2, slenderer than this and with a very narrow insertion, rather abruptly stouter at apical third, corrugated and terminating above in a small callosity resembling a similar organ in Phylloxera; joints 4 and 5 sub-equal in length, each nearly as long as 2, joint 5 bearing a short spine anteriorly near apex; joints 6 and 7 sub-equal in length, each somewhat longer than 2, 7 with a stout spine at tip; joints 4 and 7 somewhat corrugate or annulate, but less so than apical third of 3. The 2-jointed tarsi about half the length of the tibia, joint 1 of the hind tarsus bearing 6 rather stout spines on each side; joint 2 supporting at base 3 rather prominent claws, the middle one longest. Ovipositor short, acute, and retractile. Eyes divided into two by a curved pointed projection from middle of cheek, the upper portion being smaller than the lower portion. Wings clear, colorless; costa delicately serrate. General color, light orange yellow, tip of rostrum black, tarsi and part of tibia orange.

IMAGO, ♂ (Fig. 24 *a*).—The male resembles the female in all important respects except in being smaller. Claspers about as long as preceding abdominal joint, or one-fifth the length of the abdomen, curved gently upwards and inwards, each bearing 4 or 5 equidistant minute cylindrical piliferous tubercles on upper and outer edge; style almost as long as claspers, rather stout at base, more slender toward tip terminating in a stout spine at upper end. Head and abdomen with heavy tufts of wax soon after issuing from pupa.

HABITS AND LIFE HISTORY.

As a rule the insect passes the winter in the full-grown larval condition. The detailed observations have all been made at Washington, and dates and periods will doubtless vary considerably out of doors in the Gulf States. Here, however, the adult insects issue during April, and begin to lay their eggs about or before the middle of the month. The eggs are attached to the under sides of the leaves by means of the pedicel described above.

Twenty-six females were examined by crushing the abdomens under a cover glass, April 21, to ascertain the number of eggs. This was found to vary from 7 to 25, but many of those examined had evidently already oviposited to some extent, and it is safe to say that the average number is close to the maximum of these figures.

Adults which have hibernated as full-grown larvæ continue to emerge as late as the middle of May, but where the leaves are badly attacked so as to be practically incrusted with the insects, about 2 per cent never

succeed in emerging. This is almost invariably the case when the hinder part of the body of one individual overlaps the fore-part of the body of another. The skin of the latter may then split, but the adult is unable to lift the body of the other sufficiently to issue unharmed. When the insect is ready to emerge from the pupa shell, the skin splits along the median line from near the front edge of the head to the front edge of the abdomen, and thence transversely to the lateral margin, as indicated in Fig. 23 *i*. The thorax of the adult insect is then pushed out first, and afterwards, gradually and slowly, the head. After the head has been extruded the insect remains stationary in an upright position. The legs seem to be free at this stage, but are not withdrawn from the pupa shell. The wings are rolled up as indicated in the figure just referred to, and make their appearance with extreme slowness, the legs remaining within the shell apparently to give a purchase which assists in this extrusion of the wings. Just before the adult is ready to issue from the pupa shell the latter becomes transparent, so that the contained insect, shrunken away from the skin, is plainly seen in all of its details, as shown at Fig. 23 *h*. In this stage the insect looks like the pupa of a Psyllid.

The color of the adult just after issuing differs somewhat from that of the more mature individuals. The thoracic lobes are bright lemon-yellow and highly polished, the head and prothorax are milk white, the antennæ pale yellow, eyes reddish brown, ocelli colorless, lower lobe of eyes purple. The wings at first appear perfectly colorless and transparent with the costa pale yellowish, the powdery whiteness so characteristic of these flies gradually appearing.

The eggs seem to be laid by preference upon the new leaves in April and May, although old leaves are also frequently well covered. The eggs remain usually about two weeks at this time of the year before hatching, although some remain unhatched for three weeks or a little longer. The egg splits along the margin at the end farthest from the pedicel and extending for some distance down the sides, so that when the young larva issues the eggshell resembles to a slight extent a bivalve shell, especially that of a freshwater clam.

The young larva is comparatively active, and crawls usually a short distance from the shell before beginning to feed. It remains in the first stage from two to four weeks before molting. The cast skins are very delicate and usually drop to the ground or are blown away by the wind, so that very few of them remain attached to the leaf. The exact periods between the succeeding molts have not been satisfactorily ascertained, but by June 14 a majority of the individuals have cast three skins.

In preparing for a molt the insect curves the abdomen upwards at considerably more than a right angle, moving it also occasionally up and down. The margin of the abdomen has at the same time a slightly undulating motion. During these movements the insect is shrinking away from the lateral margin until it eventually occupies only about one-third of the original lateral space, causing a distinct dorsal and

ventral median ridge. The skin then splits, not on the dorsum, as would be expected, but either at the anterior end or underneath the head. The head and prothorax are then pushed out and the skin is gradually worked backwards by means of the abdominal motions, the portion already out swelling as soon as it is free.

By the end of June the adults begin to issue in numbers, and experiments were made at this time to ascertain the length of life of the adult with the result that while one individual lived for 20 days, the great majority died before the end of 9 days. Some experiments made during the latter half of May show that the life duration is considerably shorter in the spring, the longest lived individuals reaching only the age of 7 days. Retarded individuals in the Insectary emerged the middle of August.

Eggs were again laid by these adults and since no further flight of adults was noticed, full-grown larvæ from these eggs in the main carried the species through the winter, making but two annual generations.

The dates given in the above account of the life history correspond reasonably well with those of corresponding periods in the insect's life in Florida, as indicated by the receipt of many specimens from Mr. C. H. Foster, of Manatee, during April and May. March 31 the specimens received from this gentleman were all in the last laval or pupal stage. April 6, eggs had already been laid, and from his correspondence we gather that oviposition continued until April 19. In a letter just received Mr. Foster informs us that adults were observed flying during March and April, June and July, and in September, thus indicating three annual generations in Florida.

In Louisiana, where the insect is known as the "White Fly," the species hibernates in the same way, as we learn from Prof. H. A. Morgan, and is especially injurious to nursery stock, causing a very marked check in the growth.

REMEDIES.

The most satisfactory remedy consists in the use of the ordinary kerosene emulsion sprayed at the proper time. Mr. Foster was kind enough to send us the most abundant material from trees in his orchard which he sprayed with standard emulsion upon our recommendation in the spring of 1892, and from careful laboratory examination of this material, from both sprayed and unsprayed trees, we are able to speak with some certainty as to the effects of the applications. In February Mr. Foster wrote us concerning an application which he had made of a lime and sulphur wash to a certain proportion of his trees. Samples which he sent indicated that more than half of the insects upon the treated trees were still alive. We advised him to substitute the kerosene emulsion and to spray at the time when adult insects were most abundant and again at the time when the young lice had issued for the most part. His first kerosene emulsion spraying was performed on March 30, and examination showed that out of a total of 229 full-grown larvæ and pupæ 157 had been killed by the application. Later spraying was performed

on the 9th and 14th of April, and while the spray destroyed the adults which it struck, the eggs were somewhat variously affected. Many of the lice received with check lots from unsprayed trees failed to hatch in both instances, the death of the leaf seeming to affect the vitality of the insect.

Several satisfactory lots were received later, however, from which by comparing the hatched with the unhatched eggs we were able to approximate the proportion destroyed by spraying. Thus, on May 6 two batches of leaves were received, the one from unsprayed trees and the other from sprayed trees. On eight leaves of the sprayed lot there were approximately 20,500 eggs, ranging from 1,000 to 5,000 on each leaf. Of these 1,230 had hatched, or about one-sixteenth, while upon the check leaves unsprayed the proportion of hatched eggs ranged from one-half to three-fourths of the whole, the remaining ones being still sound. It must be remarked further that only a small proportion of the larvæ which had hatched from the eggs upon the sprayed trees had settled and appeared in a healthy condition, but owing to the fact that the leaves were plucked and transmitted through the mail, we are unable to state the precise significance which this condition of affairs may have. It was noticed, however, that upon the unsprayed leaves a considerable portion of the larvæ were still present, some already in the second stage and apparently in a healthy condition.

Another spraying was made by Mr. Foster upon May 4, at which date the majority of the eggs had hatched. Here again transmission through the mail dissipated any exact conclusions to be arrived at from the office examination, but the indications all favor the conclusion that the spraying was successful. Large numbers of egg shells were found upon leaves sent in after this spraying, but very few larvæ were found. The great majority had apparently been killed and had dropped. Of those which settled the greater number were dead and had turned brown and at least one-half of the few still alive were apparently affected by the emulsion. In round numbers about one-tenth of one per cent of the hatched larvæ were still living and as just stated only about one-half of these appeared healthy.

From these experiments we may state that the best time to spray is after the eggs have hatched, and we may approximately indicate as the best means of selecting the proper time, say three weeks after the bulk of the adult insects of the spring brood are seen to be flying about the trees. This should be supplemented by spraying at the corresponding period in September, and as a result the numbers of the insects will probably be reduced to such an extent that they will do little injury the following year unless the trees are again stocked from neighboring unsprayed groves.

NATURAL ENEMIES.

The ordinary scale-feeding insects, so many of which have been enumerated in Mr. Hubbard's report on insects affecting the Orange, feed

with equal rapacity upon this insect. From this particular species we have reared no parasites, but in general the Aleyrodidæ are quite subject to the attacks of Hymenopterous parasites peculiar to them. We have reared several species of these parasites from other species of this family in this country, but we will leave their characterization and consideration to a future article, in which we hope at the same time to describe several species of the family Aleyrodidæ found commonly upon different trees in the United States.

THE PEAR-TREE PSYLLA.

As an elaboration of the short paper published in No. 2 of the current volume of INSECT LIFE, and first read before the Association of Economic Entomologists at Rochester, Mr. Slingerland gives the results of his observations upon this important pear tree pest in one of the most creditable and useful of the station bulletins.*

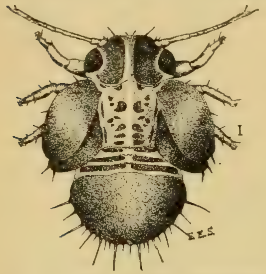


FIG. 25.—*Psylla pyricola:* full-grown nymph, dorsal view—enlarged (after Slingerland).

Psylla pyricola is an old offender and its natural history has been repeatedly treated both in Europe and America, but never before so thoroughly as has been done by Mr. Slingerland. It appears from his careful observations, made in 1892, that the hibernating imagos emerge from their winter retreats on the first warm days of spring, copulate, and commence to lay eggs about the middle of April. The eggs hatched about four weeks later, and the imagos of this first summer generation appeared from June 10 to June 15. The cycle of the second generation was completed about one month afterwards, that of a third generation also one month after the second (about August 20), and the imagos of a fourth generation, which issued toward the end of September, lived throughout the winter.

The development of the second generation was carefully followed out with the following result:

Duration of egg state from 8 to 10 days.

First larval stage: duration six or seven days. Larva 0.013 inch in length, antennæ 3-jointed; wing-pads not visible; general color pale translucent yellow, without markings; abdomen more opaque and darker.

Second larval stage: duration about four days. Larva one-third larger than first stage, but of same color, except that the tips of antennæ are black. Antennæ 4-jointed; segments of abdomen more distinct, and wing-pads developing.

FIG. 26.—*Psylla pyricola:* adult—enlarged (after Slingerland).

Third larval stage: duration about three days. Larva 0.027 inch in length; black

* Bulletin 44, Cornell University Agricultural Experiment Station, Entomological Division. Ithaca, N. Y., October, 1892.

markings begin to appear; wing-pads larger and blackish; antennæ 6- or 7-jointed, the last three joints being black.

Fourth larval stage: duration about four days. Length of larva 0.038 inch; black markings usually quite distinct; wing-pads still larger; antennæ 8-jointed.

Fifth stage: duration five or six days. This proved to be the pupa state, and the pupa differs from the preceding larval stage only in the more intense and more numerous markings on the thorax.

Not the least interesting point in Mr. Slingerland's account is the discovery that *Psylla pyricola* offers a very marked example of seasonal dimorphism. That hibernating imagos of Psyllidæ usually differ from the summer generation in the more intense coloration of the body, and sometimes also of the wings, has long been known, and the explanation given for this difference is that Psyllidæ acquire their full coloration very slowly and that the older they become the more pronounced and darker are the markings. The short-lived summer generation or generations are thus, as a rule, lighter-colored than the long-lived winter generation, and the latter gradually acquires the more intense color. This is well exemplified in our common *Trioza tripunctata* Fitch and *Aphalar acalthæ* L., which have at least two annual generations,* but in these instances there is no sharp delineation between the summer and winter forms. Now, Mr. Slingerland establishes the fact that in the winter generation of *Ps. pyricola* there is no such gradual change in coloration, but that in the fall of the year there issues from the nymphs a hibernating generation of imagos which are at once uniformly different from the imagos of the summer generations. Mr. Slingerland says:

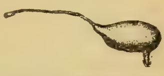


FIG. 27.—*Psylla pyricola*: Egg—enlarged (after Slingerland).

The hibernating adults differ from the summer adults in size, being nearly one-third larger; in their much darker coloring, the crimson becoming a dark reddish brown; and especially in the coloration of the front wings. The summer forms or typical *pyricola* have the veins, even in darker specimens, of a light yellowish brown color, and the whole front wing has a slight yellowish tinge. The veins of the wings of the hibernating adult are invariably of a dark brown or black color; the front wings are quite transparent, with more or less blackish shades in the cells and a blackish shade in the basal cell along the whole suture of the clavus. The male genitalia differ slightly in size in the two forms.

This winter form has been identified as the *Ps. simulans* Förster, which by European authors has always been considered as specifically distinct from *Ps. pyricola*.

The discovery of this seasonal dimorphism is certainly a matter of great interest, but that the last word has not yet been said on the subject would appear from the fact (overlooked by Mr. Slingerland) that

* Other hibernating Psyllidæ, which, in all probability, have two or more annual generations, *e. g.*, our common grass Psyllids, *Livia vernalis* and *L. maculipennis* Fitch, do not differ appreciably from the summer forms. All specimens of the genus Pachypsylla found in early spring are darker or more sordid than those found late in the fall, but in this genus there is no summer generation of imagos.

Psylla simulans is in Europe a summer form. Dr. Franz Löw* distinctly states: "The imagines were found in summer on these plants" [*Pyrus malus* and *P. communis*]; and at another place† he states that the specimens were found by himself: "I found this species hitherto only on the apple tree in company with *Ps. pyricola.*" Mr. John Scott‡ says of his *Ps. pyri* (=*simulans*): "It lives on pear trees, and is to be found from June to October;" but this is apparently not based on actual observation, and probably taken from Curtis's account of *Psylla pyri* (=*pyricola*). Finally, it is more than probable that hibernating specimens of *Ps. pyricola* have been collected and examined by authorities in Europe. Dr. Fr. Löw would scarcely have made the statement regarding the hibernation of this species without having seen specimens found in winter time.§

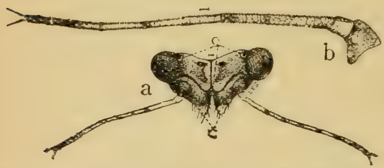


FIG. 28.—*Psylla pyricola*: *a*, head of adult, front view; *c*, cones of clypeus; *o*, ocelli; *b*, antenna of adult—all enlarged (after Slingerland).

There is plainly an error somewhere and the following explanations suggest themselves: (1) Either Mr. Slingerland may have been dealing with two distinct species occurring at the same time on his trees; or (2) we have been mistaken in the identification of the winter form as *simulans* (the determination was made from a study of descriptions and not from comparison of specimens); or (3) the European observations are faulty; or (4) the hibernating form in central Europe extends into summer. We feel confidence in Mr. Slingerland's views, and shall expect the final explanation to justify them.

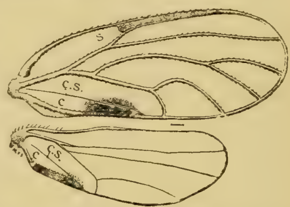


FIG. 29.—*Psylla pyricola*: venation of wings; *s*, stigma; *c*, clavus; *cs*, claval suture—enlarged (after Slingerland).

The various life-habits of both the adolescent and adult stages of the insect are more or less fully dealt with by Mr. Slingerland, and of the many interesting and novel observations we select here for quotation those made on the honey-dew:

Many have supposed that the honey-dew, so conspicuous a feature in severe attacks of this pest, is the sap of the tree which exudes through the punctures made by the insects. As the honey-dew occurs in such immense quantities it does seem almost impossible that it is wholly the secretion of the little creatures. All of this fluid does, however, first pass through the body of the insect. The amount which a

*Uebersicht d. Psyll. von Oesterreich-Ungarn, etc., 1888, p. 15.

†Neue Beiträge, etc., 1886, p. 157.

‡Trans. Ent. Soc., London, 1876, p. 537.

§In his Revision d. paläarct. Psyll., 1882, p. 232, Dr. Löw seems to be inclined to consider *Ps. argyrostigma* Först. as the winter form of *Ps. simulans*.

single individual will secrete during its lifetime is small, but when many thousands of the insects occur on a tree the aggregate becomes large. A single nymph isolated in a cage secreted at least four drops (*i. e.* four minims) of the fluid before it became an adult. Thus fifteen nymphs would secrete one drachm.

The food of the insect consists entirely of the sap of the tree. * * * In the case of the nymphs most of the food is elaborated into honey-dew; some is assimilated, and the waste matter voided as excrement. The adults, however, seem to secrete no honey-dew, all the food being assimilated. Consequently the adults void considerable quantities of excrement, much more than do the nymphs.

The honey-dew and excrement are very different substances, but the fact does not seem to have been before observed. The honey-dew is a clear, water-like liquid and forms into globules when secreted. The excrement, however, is a whitish semi-solid substance which is voided in long cylindrical strings or minute whitish balls which roll from the anus like quicksilver globules. * * * Many observations were made to discover, if possible, the manner in which the honey-dew was secreted by the nymphs. It has been supposed that the secretion came either from the long so-called wax-hairs around the edge of the abdomen, or from excretory pores on the dorsum of the abdomen. Globules of honey-dew were, however, seen attached to the nymphs in such a position that it seemed very improbable that it came from either of the above sources; it seemed that it must have been secreted from the anus of the nymph. A German observer now asserts that the honey-dew secreted by the common plant-lice or Aphids comes from the anus, and not from the honey-tubes as commonly supposed.* Honey-dew thus seems to be what might rightly be called the fluid excrement of the insect.

A full account is given of an extensive series of experiments to ascertain the best remedy. All experiments upon the eggs failed but the young nymphs were shown to be very susceptible to the action of kerosene. The standard emulsion, even when diluted with 25 parts of water and thus containing less than 3 per cent of kerosene, was very efficacious. From 75 to 90 per cent were killed with one spraying in this proportion. The nymphs have a habit of clustering in the leaf axils and as the liquid naturally runs down the leaf petioles and twigs the insects are readily reached. Two quarts of the dilution were sufficient for a large dwarf pear tree and thirteen such trees can easily be sprayed in half an hour with a knapsack sprayer. The best time to spray is said to be in the early spring just after the leaves have expanded.

Very full technical descriptions are given of the full-grown nymph and the summer and winter forms of the adults.

In the description of the imago Mr. Slingerland introduces for the various parts of the body a terminology which differs from any other in use for this family. In fact, in the Psyllidæ we have almost as many different terminologies as there are authors. This by no means facilitates the study of these insects, and there is no good reason for the term "clypeus" or "cones of the clypeus" (see Fig. 28, *c*) for that part of the head which, following Löw, we have called "frontal cones" (Scott's "face lobes"). In Psyllidæ the clypeus is to be looked for on the underside of the head where it is visible as a more or less knob-shaped (very rarely more elongate) protuberance a little in front of the anterior coxæ. The

* M. Büsgen, Jenaische Zeitschrift, vol. xxv, pp. 339–428 (1891).

term "epicranium" used by Mr. Slingerland is no improvement on "vertex" (Scott's "crown of the head.")

The penis in Psyllidæ is not a paired organ as described by Mr. Slingerland but consists of a single very slender tube which is geniculated in the middle. In most cabinet specimens it is either folded up and entirely hidden from view within the trough of the lower genital plate or only the angle formed by the geniculation of the middle is visible.

Mr. Slingerland calls attention in a note to a stupid error in the translation from Löw in INSECT LIFE (vol. IV, p. 127.).

Original figures are given of the egg, the full-grown nymph, the adult insect, enlarged genital segments of the male and female, of the head and antennæ of the adult and of the venation of the wings. With the author's permission and assistance we reproduce some of these. The bulletin closes with a careful bibliography and synonymy.

THE LANGDON NON-SWARMING DEVICE.

By FRANK BENTON.

Complete control of natural swarming has long been regarded by apiarists as one of the most desirable points to accomplish in connection with their pursuit. Yet, up to the present time, notwithstanding the improvements which modern ideas in apiculture have suggested in this direction, they have had to admit it one of the most puzzling with which they have had to do.

The advantages in being able to suppress at will and without detriment to the colony the desire on the part of the bees to swarm are numerous. Chief among these may be mentioned: There need not then be the great interruption to honey storing which the issuance of swarms brings in the height of the honey yield. The apiarist could have all his return in the shape of honey instead of partly in the form of swarms, clearly an advantage when the number of his colonies had reached the limit of his field or as many as he could well care for and remunerative prices could not be obtained for the surplus stock. The time and labor expended in watching for and hiving swarms would be saved. Losses through the absconding of swarms would be avoided. Even with all reasonable care such losses often occur.

Centuries ago the Greeks recognizing some of the advantages which the control of swarming would give to the bee-keeper, practiced with their basket-hives furnished with bars across the tops, the transfer of combs with adhering bees to new hives thus forming artificial swarms. This is interesting to note as being the first recorded attempt to control swarming. Contardi, who wrote in 1768, describes these hives and says: "When the bees should swarm those people do nothing but to take out some of these bars to which the bees attach their combs, and

they place them upon another basket or hive. It is in this manner that the Greeks multiply their hives." The abbot, Della Rocca, of Syra, in the Grecian archipelago, in his *Traité complet sur les Abeilles*, published at Paris in 1790, mentions this as "a method of the ancient Greeks for the multiplication of swarms, which is employed today by the inhabitants of the Island of Candia." And Liger, the author of *La Maison rustique*, in the eighth edition published in 1742, gives a figure of one of these basket hives, which is here reproduced (Fig. 30).

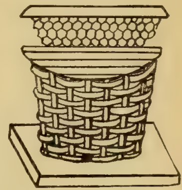


FIG. 30.—Ancient Greek movable comb hive. (From *La Maison rustique*, published in 1742).

Most of the systems of preventing or limiting natural swarming have depended upon the formation of a limited number of artificial swarms, frequent destruction of queen-cells by the bee-keeper, close use of the honey-extractor, the combining of after-swarms, changing places for hives, replacing of all queens annually, supplying empty space for comb-building below the brood-nest or between the brood-nest and flight-hole, or there has been some combination of these methods.

NON-SWARMING BEES, AUTOMATIC SWARM-HIVERS, ETC.

From time to time queens have been advertised as bred from "non-swarming strains of bees." While it is very reasonable to suppose

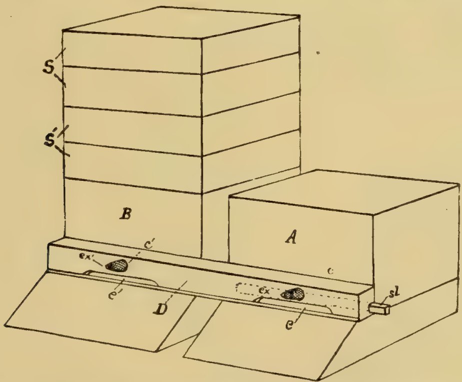


FIG. 31.—Bee-hives with Langdon non-swarmer attached: *A*, *B*, hives; *S*, *S′*, supers; *D*, non-swarming device; *e*, *e′*, entrances corresponding to hive-entrances; *sl*, slide for closing entrance; *c*, *c′*, conical wire-cloth bee-escapes; *ex*, *ex′*, exits of same.

that the inclination to swarm might be decreased considerably by long-continued, careful selection, such as could be given had we better control over mating, it is safe to say that comparatively slight permanent results have thus far been attained in this direction. And since swarms

would issue various devices have been constructed to warn the owner or to prevent loss during his absence. Electric attachments and telephone lines have been put up, adjusted entrances to confine queens, traps to catch the latter, and decoy-hives have been used, and at last the automatic or self-hiver has been evolved after many experiments and much thought on the part of apiarian inventors. Although the self-hiver in its more perfected form has scarcely been subjected to a thorough test it promises to do all that has been expected of it. But it will not

TAKE AWAY THE DESIRE TO SWARM.

This is exactly what Mr. H. P. Langdon, of East Constable, N. Y., says he can do by the use of the non-swarming attachment invented by him and now for the first time made public. Moreover, he keeps all of the field force of his colonies storing surplus honey under the most favorable conditions as long as there is any honey to be obtained in field or forest, and simplifies to such an extent the work of the apiary during this portion of the year that he can attend to several times as many colonies as under the old way.

The immediate condition which incites a colony of bees to swarm has been quite well recognized as its general prosperity—its populousness, the abundance of honey secretion, and crowded condition of the brood combs, or, in general, such circumstances as favor the production of surplus honey, especially surplus comb honey, and it has of course been taken for granted that honey could not be secured if these conditions were changed. Nor would it, without any knowledge of the system proposed by Mr. Langdon, be easy for experienced bee-keepers to believe that all it proposes to do could be accomplished without much manipulation and perhaps also the use of some complicated device. I was, however, agreeably surprised at the whole simplicity of Mr. Langdon's plan, when, in December last, he made it known to me and sent a non-swarmer for purposes of illustration. And in answer to his request as to what I thought of it, I wrote him at once that I was of the opinion that he had made one of the most valuable additions to the list of apiarian inventions that had appeared for a long time—one that, after the frame hive, would rank equal with or ahead of the honey-extractor and comb-foundation machine.

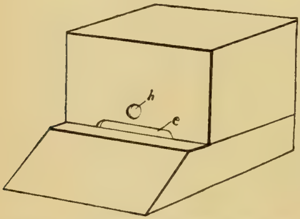


FIG. 32.—Hive showing entrance (*e*) and hole (*h*), corresponding to like apertures on back of non-swarmer.

Mr. Langdon has applied for letters patent on his device in this and other countries, and with the specifications as a basis, a copy of which

he has kindly sent to me, together with permission to make the matter public, I have written the following

DESCRIPTION OF THE DEVICE AND SYSTEM.

At the beginning of the honey season the non-swarming device, D, shown in Fig. 31, is placed at the entrances of two contiguous hives each of which contains a queen and full colony of bees. The continuous passageways, *e* and *e′*, on the underside of the device, correspond to the entrances of the hives A and B, respectively. The bees will then pass, quite undisturbed, out of and into their respective hives through these passageways. By inserting the slide, *sl*, in the end of the non-swarmer until it occupies the position indicated by the dotted horizontal lines the passageway leading to hive A will be closed at its juncture with the hive-entrance, preventing any bees from entering said hive. The wire-cloth cone exit, *ex*, still permits flight-bees to come out of hive A, as a hole, *h*, Fig. 33, through the non-swarmer connects

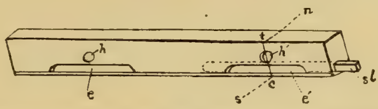


FIG. 33.—Langdon Non-swarming Device—rear view, showing apertures (*e*, *e′* and *h*, *h′*), corresponding to similar openings in the fronts of hives.

the cone exit with a corresponding hole, *h*, Fig. 32, in the front of the hive. The super cases S of hive A are then placed on those of hive B.

The flight bees of hive A finding their hive-entrance closed on their return are, upon alighting at the entrance *e*, Fig. 31, attracted along the gallery shown at *g*, in the cross section, Fig. 34, by the buzzing of the bees at the entrance *e′* of hive B, and enter said hive. This withdrawal of the field-bees from hive A leaves this hive so depopulated and so disconcerts the nurse bees left therein that they will not swarm; meanwhile work is going on without interruption in the supers on hive B by the field force of both hives.

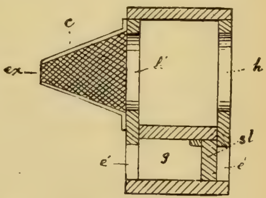


FIG. 34.—Langdon Non-swarming Device—cross-section at *sctn.*, Fig. 33 (lettering as before).

At the expiration of eight to ten days, thus before the bees of hive B have made preparations to swarm, the supers, S and S′, Fig. 31, on this hive are all transferred to hive A, the slide, *sl*, is withdrawn from entrance *e*, thus opening this hive, and is inserted in the opposite end of the non-swarming device so as to close the entrance, *e′*, to hive B. The bees thus excluded from hive B will be called along the gallery, *g*, Fig. 34, of the non-swarmer by the bees at the entrance, *e*, and with these

bees will enter hive A, thus bringing about in hive B the same conditions as were previously induced in hive A by closing the latter. At the same time the field-bees of both hives are working continuously in the supers on the hive A, the entrance of which is open, and the flight bees in hive B are escaping through the cone exit, *ex′*, and joining those of hive A.

In about a week the supers are again placed upon hive B the entrance to which is then opened while that of hive A is closed. In another week another transfer is made, and so on alternately during the flow of honey.

This alternate running of the field-bees from one hive to another and back again, and the simultaneous transfer of the supers, so disturbs the plans of the nurse-bees and temporarily depopulates the hives successively closed, that organization for swarming is not effected, hence, *no swarms issue, and the field-bees of both hives work unitedly and without interruption throughout the entire gathering season.*

ADVANTAGES OF THIS SYSTEM.

The experienced bee-master will not only readily see that this meets the requirements mentioned in the first part of this article as advantageous to secure, but also that in many other ways it is likely to prove a system of great value in the apiary. Mr. Langdon has mentioned some of these and I will therefore quote from his letter:

(1) Two light colonies that would not do much in sections if working separately make one good one by running the field force of both into the same set of supers.

(2) No bait sections are needed, as the bees can be crowded into the sections without swarming.

(3) The honey will be finished in better condition, that is, with less travel-stain, because the union of the field forces enables them to complete the work in less time.

(4) There will be fewer unfinished sections at the close of the honey harvest, for the reason just mentioned.

(5) Also for the same reason honey can be taken off by the full case instead of by the section or holder full.

(6) Drones will be fewer in number, as a double handful will often be killed off in the closed hive while the other is storing honey rapidly.

(7) Artificial swarms and nuclei can be more easily made, as combs of brood and bees can be taken from the closed hive in which the queen can be found very quickly.

As there is in carrying out this system of swarm prevention no caging of queens, cutting out of queen cells, manipulation of brood combs or even opening of the brood chambers at all during the honey season, and all the vexatious watching for swarms and the labor and time involved in securing these are done away with, and instead of this a simple manipulation attended to not oftener than once a week is substituted, it is plain that very many more colonies can be managed by one person, and, indeed, Mr. Langdon informs me that he "can care for 200 colonies with one day's work in a week with no help, instead of working

all the time with 100 colonies." It will, therefore, prove a great boon to all having numerous out-apiaries.

One of the greatest advantages over any plan for the prevention of swarming yet proposed, which Mr. Langdon's system will have, should it prove on further trial all that it now promises, is that it will not only prevent more effectually than any other the actual issuance of swarms, but, while not requiring any manipulation antagonistic to the known instincts of bees, it will prevent all desire to swarm—will completely do away with the "swarming fever," so fatal to the hopes of the comb-honey producer. Another great feature of it will be the more rigid selection of breeding stock, which it will facilitate. Intelligent selection can accomplish for this pursuit as much as it has done for the breeders of our larger domestic animals. Furthermore, a strong natural inclination toward swarming on the part of any race of bees, otherwise possessed of very desirable traits, will not, under this system, oblige the rejection of such race. Eventually the disposition to swarm must through constant suppression become less, or, in time it may even disappear, giving us the long-sought non-swarming strain.

THE SYSTEM TESTED PRACTICALLY.

A brief statement of the success which has attended Mr. Langdon's practical test of his system during 1892 will be of interest in this connection. In a letter dated December 24, 1892, he wrote:

> Last season I tried the device on 100 hives. Except in one instance the bees did no fighting. Why they do not fight when united in this way I can not say. It certainly did not discourage them in honey gathering, for my yield from the 100 hives was 6,000 pounds of comb honey, or an average of 60 pounds per hive, some pairs yielding 150 pounds, and it has been counted a poor season for bees in my locality this year. After one season's trial of the device and plan I do not know of a single fault or objection to it.

NOTES ON APHIDIDÆ.*

By Herbert Osborn and F. A. Sirrine, *Ames, Iowa.*

The following notes upon the habits of certain species of Aphides can not be considered as absolutely proving migrations, though it is thought for some of them that the observations approach demonstration.† We would prefer, of course, to be able to state our conclusions

*Under this title the authors presented at the meeting of the Iowa Academy of Sciences, December 28, 1892, a number of additions to the list of known Iowa species and some biological notes. The latter only are reproduced here.

†We have made many similar observations and a large number are recorded in our notes, yet unpublished. We can thus confirm several of the observations of Prof. Osborn and Mr. Sirrine, and particularly the one regarding the apparent identity of *Colopha ulmicola* and *C. eragrostidis.* We are convinced of the identity of these two species which occur commonly upon Ulmus and Eragrostis at Washington, although we have not succeeded in satisfactorily colonizing individuals from the grass upon the tree.—C. V. R.

with greater certainty and it might be wiser to hold these notes for future proof. Experience, however, has shown that it is often impossible to find material for continuous study in any one locality and we hope that the publication of the facts gathered so far may assist in the collection of proof relating to the exact cycles of some of the migratory species in this interesting group. We are aware, of course, of the studies of Lichtenstein and others in this field, but only a portion of the papers containing their results are accessible at present, and so far as we know no observations have been made on the particular species here mentioned. So that in any case they may be considered independent observations and, if duplicating work already done, furnish confirmatory evidence.

Siphonophora sp.—Found abundantly on leaves of Hop Hornbeam (*Ostrya virginica*). It is apparently identical with *S. geranii* Oestlund, on geranium and we suspect will be found to be migratory between these two plants.

Rhopalosiphum nymphææ L.—On *Nymphæa odorata*, Pond Lily. What is apparently the same species occurred also on the Arrow Leaf, *Sagittaria variabilis*, and this may doubtless be considered as a host plant.

Hyalopterus pruni Fab.—On Plum and Choke Cherry.

Hyalopterus arundinis Fab.—(= *pruni* Fab. ?).—On *Phragmites communis*. At first only the winged form of *Hyalopterus pruni* was found on the Plum and in no case was the apterous viviparous form found. The blades of Phragmites showed that the Aphidids had been there for some time and probably for the most of the summer. Pupæ of both viviparous females and of the males were found in the colonies on Phragmites. There is no difference in structural characters of the winged viviparous forms found on Plum and those found on Phragmites. Slight differences may be noted in color, evidently due to age. Hence it seemed more than probable that this Aphidid migrated from the grass to leaves of some of the plum family to deposit the oviparous females, the latter depositing their eggs around the buds.

Winged forms were taken from the grass and confined on leaves of Plum. These winged forms established colonies of oviparous individuals and these deposited eggs around the buds.

Monellia caryella Fitch.—On *Hicoria alba* and *amara*. One specimen listed in previous list, a single specimen from a small colony having been secured a few years ago. The species was rather common this season, a point of interest, since this species was for some thirty years after its description by Fitch unrecognized by any other entomologist, but was a few years ago recorded in Minnesota by Mr. Oestlund about the same time our specimen was taken here.

Callipterus bellus Walsh.—On *Quercus coccinea?* In markings this resembles Monellia.

Callipterus asclepiadis Monell.—On *Asclepias cornutum.*

Callipterus discolor Monell.—On Oak. This and the preceding seem to be identical so far as descriptive characters go, even when compared

side by side in fresh specimens. It seemed possible that they move from Milkweed to Oak in autumn, but egg-laying broods and eggs were found on both plants.

Tetraneura graminis Monell.—On *Leersia virginica.*

Tetraneura ulmi L.—On *Ulmus americana.* Winged forms of *Tetraneura graminis* were found flying from *Leersia virginica* and at the same time winged specimens of *Tetraneura ulmi* were observed alighting and hiding under rough bark of the Elm, where afterward the peculiar males and females of the latter were found, as also the single egg of the female.

Colopha ulmicola Fitch.—Specimens this season were taken on the bark of Cork Elm in October.

Colopha eragrostidis Middleton.—On *Eragrostis frankii* and *purshii.* Not compared with the original description. So far as descriptive characters go, there is no difference between this species and the *ulmicola* occurring on Elm.

Pemphigus attenuatus n. sp.—On *Smilax rotundifoliæ.* They accumulate in colonies extending for a foot or more along the vine and give it the appearance of being two or three times its normal diameter and of a grayish woolly surface, or as if covered with some abnormal growth. The lice hang by their beaks, with the end of the body held at right angles to the vine, so that the outer surface is quite uniform. Some specimens, nearly the same if not identical with the winged forms on Smilax, were taken in August, 1889. These were covered with an extremely long, white excretion. In flight the dense cottony mass made them appear like large flakes of snow.

Description.—Body robust, purple, black. Head broad. Antennæ wide apart, nearly as long as body, dusky throughout. Wings narrow, attenuate at tip, veins very slender. Legs black, tibiæ slightly pale toward apex. Described at time of collecting.

Alate viviparous form.—Length of body, 1.8 to 2^{mm}; of antennæ, 1.33 to 1.34 (I, 0.5^{mm}; II, 0.12^{mm}; III, 0.22^{mm}; IV, 0.25^{mm}; V, 0.30^{mm}; VI, including nail, 0.30^{mm}). Width of body, 0.7^{mm}. Length of wing, 3.6 to 3.9^{mm}; width, 1^{mm}. Rostrum reaching beyond second pair of coxæ. Wings narrow, pointed, from which the name is derived. Third discoidal obsolete at base, the first and second discoidals approximate at point of issue. The same is true of the discoidals of hind wings. Stigma long and narrow. Stigmal vein nearly straight and running nearly to apex of wing, approaching in this respect some species of Lachnus. Cauda and cornicles obsolete. Antennæ not annulate, third joint with a few enlarged sensoria, remaining joints slightly rough or irregularly rugose. From specimens in balsam.

Apterous viviparous form.—Length of body, 3.50 to 3.90^{mm}; width, 1.80 to 2^{mm}. Length of antennæ, 1.30 to 1.40^{mm} (joint I, 0.10^{mm}; II, 0.15^{mm}; III, 0.32^{mm}; IV, 0.25^{mm}; V, 0.27^{mm}; VI, 0.30^{mm}). Antennæ slightly roughened and with a few hairs. Rostrum reaching second pair of coxæ, stout. Body walls and appendages brown, the fluids of the body give a dark olive-green background, while the whole surface is covered with a gray flocculent secretion.

In balsam the color changes to a purple black. Cauda obsolete. Cornicles barely indicated.

Apterous males or larvæ (?)—Length of body, 1^{mm}; width, 0.4 to 0.5^{mm}. Rostrum reaching nearly to end of abdomen, stout. Antennæ length 0.7^{mm}; only five joints visible. Eyes small, red.

BELVOSIA—A STUDY.

By S. W. WILLISTON, M. D., *Lawrence, Kans.*

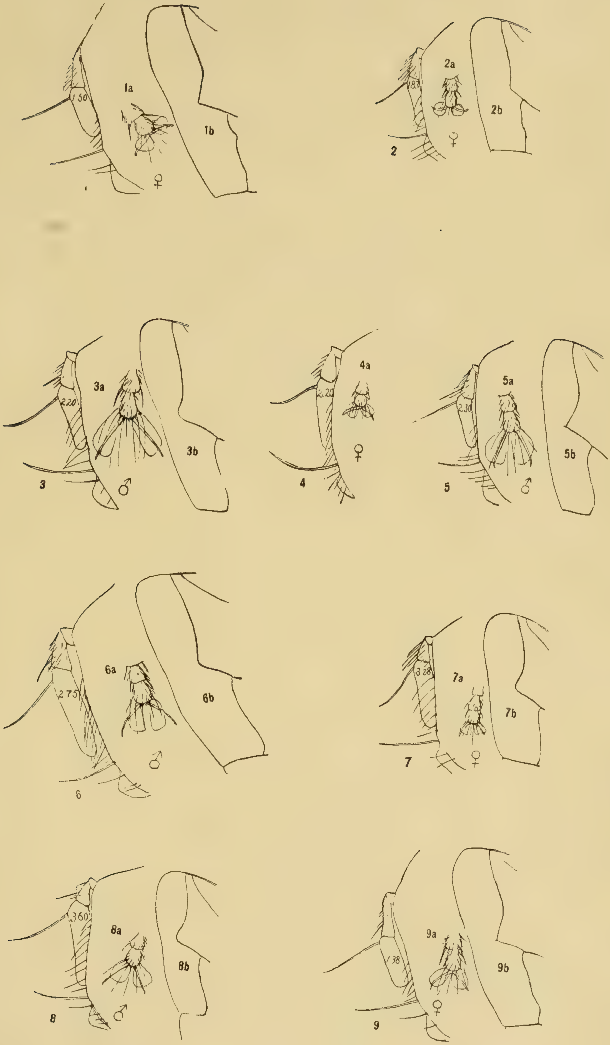
In Brauer and Bergenstamm's recent work on the "Muscaria schizometopa" there is given a list of over four hundred genera of Tachinidæ accepted by the authors, one hundred and eighty of which have been recently proposed by themselves. To these must be added forty-three proposed by Townsend within the past two years, making altogether about four hundred and fifty current genera in this one family.

It may be interesting to note that the entire number of species studied by Brauer and Bergenstamm is given at fifteen hundred. Presumably a large proportion of these were from Europe, where the family has been most studied, especially by Desvoidy, Rondani, Schiner, and Kowarz. In the United States there are, I am confident, at least six hundred species in collections at the present time, and probably more than twice as many in reality.* At present the North American species are distributed among about one hundred and thirty genera, about one-half of which are unknown to occur outside of these limits—a remarkably high proportion.

It will be a long time before the family is as well known as are many other families of American Diptera, and the reasons therefor are not hard to find. Species, genera, and even families show such slight plastic or colorational differences that only the most patient study will define their limits. At the present time there is a decided tendency to base the classification of even the higher groups upon apparently trivial characters. Most naturalists have long since abandoned the idea that genera, or even families, represent anything but the conveniences of classification, and the recent writers on this family are probably right in seizing upon any characters that will satisfactorily group the vast number of species irrespective of their relative values. But it is very probable that, in the proposal of so many genera in such rapid succession, many characters have been employed which future research will show to be entirely inadequate. We yet know very little about individual variations in this family, or the real value of many of the characters now used. The absence or presence of a bristle may be found to represent a group of species, but we should first learn how constant the character is in species.

What I would here offer are the results of a study of considerable material, which has until recently been considered to belong to a single species, but which is now thought to appertain to distinct genera. I have selected and figured, almost at haphazard, nine specimens, every one of which presents so-called specific or generic characters. I could

* My own collection of South American Tachinidæ includes over four hundred species.



VARIATIONS IN THE OLD BELVOSIA BIFASCIATA FAB.—ENLARGED.
(From drawings by Dr. S. W. Williston.)

probably have added nearly as many more from among my forty specimens, but what I here give will suffice for the present. I would premise their discussion with the statement that each one of the figures has been made very carefully with a camera lucida, and are all magnified, so far as possible, the same.

In the Transactions of the American Entomological Society (vol. XIII, p. 302), I ventured the opinion that what had previously been considered as the two sexes of *Belvosia bifasciata* in reality represented two distinct species. The reasons that I gave were the differences in the lengths of the antennal joints and the course of the last section of the fourth longitudinal vein, to which Townsend has recently added the bristles of the facial ridges. Apparently without due deliberation, Brauer and Bergenstamm later * made use of these characters to distinguish the forms generically.

As most of the characters which these authors use for this group seem of doubtful value, I will quote rather fully from their writings, as follows:

Vibrissæ reaching beyond the middle of the face. Head swollen, as in Gonia. Face perpendicular, os somewhat retreating. Vibrissal angle situated rather high above the oral margin, the latter somewhat projecting below .... *Willistoniidæ*

Sides of the face broad, hairy on the upper part only. Third joint of the antennæ 2–3 times as long as the second, long, linear. Arista thick, second joint short. Male without, female with, 3–4 orbital bristles. First posterior cell terminating before the tip of the wing, open. Angle with or without a small stump [Faltenzinke].

Third joint of the antennæ not three times as long as the second (2–2½). Angle of the fourth longitudinal vein approximated to the posterior margin, V-shaped, with a small stump. Claws of the male much elongated, of the female short .... *Willistonia esuriens, bicincta*, etc.

Angle of the fourth longitudinal vein obtuse [*i. e.* rounded, stumpfwinkelig], not approximated to the border, separated at least as widely as from the posterior cross-vein. Claws of the male short and like those of the female. Third antennal joint fully three times as long as the second .... *Latreillia bifasciata*

I have omitted some portions of the diagnoses as irrevelant, and have inserted *W. bicincta* from their later list.

It seems that the authors must have studied additional material later, as in the second part of the work (p. 45) they say that "the length of the antennal joints will not distinguish between the two genera, Willistonia and Latreillia, and should be stricken from the diagnoses." They still retain the two genera and the "family," however, apparently upon the antennal and neurational characters.

Let us now compare the figures (see Plate I). In Fig. 9 it is seen that the third joint of the antennæ is but 1.38 times the length of the second joint, and the last section of the fourth vein (9*b*) is angulated and with a stump of a vein. The figure clearly represents a Willistonia B. and B. In Fig. 1 the third joint is longer, and there is no stump of a vein; still, the species will go readily in Willistonia by throwing out the character of the "stump." Fig. 2*b* shows the species to be a Latreil-

* Die Zweifl. d. k. Museums zu Wien, vol. IV, p. 29.

lia, though the third antennal joint is less than twice the length of the second; the antennal character here loses its generic value. Fig. 3 shows the markedly characteristic claws of Willistonia, and the approximation of the angle to the hind border; but the angle is markedly rounded, a distinguishing character of Latreillia; evidently the "stumpfwinkelig" angle has to be given up. Fig. 4 is that of a typical female of Willistonia. In Fig. 5 we get all the characters of a Willistonia; there can be no doubt about this specimen, though the claws are not as large as in the specimen from which Fig. 3 was taken. Fig. 6 must go in Latreillia, though the claws are enlarged and the third joint of the antennæ is not "reichlich dreimal so lang als das zweite." Figs. 7 and 8 show the third joint of the antennæ much elongated, the claws of the male enlarged, the rounded angle of Latreillia, and the marked approximation of the angle in 8*b*; here we must abandon the claw-character.

Do these characters need any comment? I trow not.

Examining now the bristles of the sides of the face one will see that they are as variable as the other characters.

Again, the pollinose band on the third abdominal segment shows a gradual variation from one covering the segment to an entire absence in the specimens from which Figs. 7 and 8 were taken, and which are, evidently, *B. leucopyga* v. d. Wulp.

It seems evident, from the foregoing, that most of the characters used by Brauer and Bergenstamm for this group are worthless, and it gives me pleasure to relegate to oblivion both of their generic names. The question remains: Are all these characters specific? That I will not attempt to answer; but, if so, instead of the three or four species now placed in *Belvosia*, there must be at least a dozen.

Seriously, is not the stock of Tachinid genera sufficiently large for the present? Would it not be advisable to study species more before making every trivial character the basis of a new genus?

I will add that Fig. 1 was drawn from a St. Dominican specimen; Fig. 2 from one from Minnesota; Fig. 6 from one from Pennsylvania; Fig. 9 from California, and the remainder from Brazilian specimens.

OBSERVATIONS ON THE BOLL WORM IN MISSISSIPPI.

By S. B. Mullen, *Harrisville, Miss.*

Not long since I promised to give, somewhat in detail, the results of my observations, in connection with work done on the Boll Worm in Mississippi, during the seasons of 1890, 1891, and 1892. At the beginning I either accepted some of the old theories or assumed one, with a purpose of establishing the same, and will say that to you my methods in many instances would appear very crude, but I hope that you will

bear in mind that my observations were made from a practical and not from a scientific standpoint. Therefore, when I saw that no good practical results could be obtained from a certain line of work it was immediately abandoned.

HABITS OF MOTH AND LARVA.—I believe that a few years ago these moths were regarded as almost strictly nocturnal in their habits. This is certainly not the case, either in feeding or oviposition, for on various occasions have I noticed them feeding freely during all hours except the early morning hours, and during the present season, especially, have noted them depositing their eggs in broad daylight, even on the dead blades of corn, but upon this point I will have more to say further on.

HOST PLANTS.—Corn is unquestionably the most preferred in a general way to all others as plants for depositing their eggs on, but they prefer plants blooming and fruiting to corn not yet tasseling and silking—a fact worthy of note. To illustrate: Should tomatoes be blooming and fruiting with corn growing by it not yet tasseling and silking, the eggs will be placed on tomatoes, but should the corn be in silk and tassel the eggs will be placed on the corn. Therefore, to protect a tomato crop the corn must be planted early and the first brood of worms crushed in the buds of the corn (not destroy the corn to get rid of the worms, as has been suggested). Let this corn be an extra early variety, and even then the tomatoes should be early also; the silk and tassels will attract the moths. But in case growers do not wish corn to remain throughout the season, if this corn be carefully watched up to the last of May but few moths will be on hand to infest the tomatoes with the second brood, and this is the brood dreaded by tomato-growers south of Kentucky or Missouri.

With cotton growers the idea is to destroy every insect, at all times, and under all circumstances. Should every southern farmer turn wrong-side outward every corn or cotton bed during early winter, but a few seasons would elapse before the Boll Worm would become a thing of the past. Two furrows with a 12-inch steel plow would accomplish this, two furrows to the row, with double team. Again, should planters and farmers determine to feed them out of cotton, corn is the cheapest and best way to do it. We know that the fourth brood is the one that plays havoc with our cotton crops unless it is late cotton; then it is the fifth brood. Adopt different ages of corn with peas planted and that will be blooming from the 1st of August on, and all will be well. Whenever these moths have filled themselves on the nectar of peas they become sluggish in their habits, and if corn is near by they will invariably lay their eggs on it. Either the surface or position of the blades seem to suit them, though dead, better than anything else to place their eggs upon. They are very fond of hiding during the day in rank peavines, grasses, and weeds around ditches and at the ends of cotton or corn rows, and I have noticed that badly cultivated grass

fields have always suffered more than fields cultivated well and kept clean.

FOOD-PLANTS OF THE MOTH.—Peas certainly occupy the first place as food-plants of the moths, in fact, nearly all insects seem to be very fond of them, ants, wasps, yellow jackets, etc. Therefore, whatever means we desire to use for their destruction should be placed near these, and, as stated above, corn will furnish the best trap that can be used. A small patch near peas will attract them, and the number of eggs laid upon them will prove a surprise to anyone who has not made careful observations on this point, and many have suggested that the corn would be injured in a corresponding measure as the number of worms increased. This is not my experience, for their cannibalistic habit serves as a check in this direction.

DISEASES.—During the season of 1880 a pale green, whitish-striped worm infested my rice, and I feared would destroy it, but after a short time they became diseased and the whole brood died out. During the latter part of the summer of 1890 I found the Boll Worms dying in a certain piece of late cotton. I watched the progress of the disease with a great deal of interest and found that most of the worms died from it. (See *Home and Farm*, December 15, 1890; also with Mally during spring of 1891.) They were found rigid, lying around the base of the form, "just as they laid down their tools," with a mold substance forming in the rings of the segments. These facts may prove of scientific interest, but I can not see how they may prove of any practical value to cotton growers, as a single dead specimen from disease was all that was found last year, and only a few this year.

NATURAL ENEMIES.—Nothing ranks with the Sapsucker as a destructive agent. When conditions and arrangements are effected, if we could or would arrange early corn about our cotton that would be silking the last of May and first of June, no doubt nearly or all of these worms could be trapped in it, and then, if there is no dying timber near, the Sapsucker will get the remaining worm or two left on the ears of corn. I have in mind the extra early varieties of corn, and I hope the Department will furnish me with the earliest variety obtainable and results will be given to you. This season much decaying timber around my farm prevented such satisfactory results as were obtained last season, or hoped for this; the birds very often worked or fed in the timber when but for the presence of the timber they would have been in the corn; last year they cleaned up all worms in my trap corn on Brush Creek. The Southern Sapsucker does no injury to corn; he seldom fails to find his worm, and as soon as it is taken out flies to another ear, and so on. It is a reflection on humanity to be guilty of this destruction. The Blue Jay and the Red Cockatoo Woodpecker, though destructive to worms, will eat corn, and a line of distinction should be drawn. Second in rank should be placed the Soldier Bugs. While making observations in the field I have often been amused watching

these insects lingering about a form. The first favorable opportunity that presented itself it would approach a worm, thrust its lance into it and in a short time the worm would drop down limp, suspended, as the bug rested and filled itself from the life fluids of the worm. It has appeared to me that they never become prominent in this work until the season is well advanced, and no way has suggested itself to me by which we might facilitate it. Many worms are infested with parasites, but we are equally powerless to facilitate their work. Ants destroy some small worms, but no doubt you have noticed how quickly a half-grown Boll Worm can dispatch an ant, unless the ant makes the attack near the head and where the worm can not reach it. One effort is generally sufficient and the ant is cut in two. I believe that Heliothis is the most vicious worm we have here.

HIBERNATION.—It is possible that some of the insects pass the winter in the moth state, but I have never been able to find them if such is the case, though I made careful observations on that point last winter, while I find and destroy them by hundreds in the pupa state and think that the normal way in which the winter is passed.

None but one raising cotton, tomatoes, and other vegetables here in the South from year to year can place a proper estimate upon the damage done by these worms. They are an abiding scourge, and he who proves himself able to control them should be recognized as a benefactor to his race. There is yet much to learn, and during the last three seasons I have learned much, and shall continue my observations and work next season, and, while I am sure that the means as suggested above will prove effectual in some cases, different methods adapted to different surroundings must be employed.

---

o

NOTES ON ENTILIA SINUATA.

By MRS. M. E. RICE, *Coryville, Pa.*

This insect was first observed on Sunflower July 15, 1892; a few were pairing. The eggs are laid in the midrib of the leaf, almost invariably on the under side. They began to hatch September 1, and almost all, a large number, were out September 10. I destroyed the Entilias on fifty leaves. By actual count there were over a thousand, and many more were knocked off by a heavy shower the night before.

Sunflower leaves infested by the larvæ die, the whole plant looking as if scorched. The larvæ are very small when first hatched, but soon grow to full size—in about two weeks when attended by ants, and in less than a week when undisturbed—when they split open on the back and the insect emerges in an imperfect form.

The larva is pale green, thickly dotted with black, and bears very little resemblence to the perfect insect. The latter, when it emerges, is also pale green. In three hours it assumes the perfect form, only still greenish white in color. Nearly every colony had members ranging in size from tiny, newly hatched larvæ to perfect insects. Many larvæ, as well as old ones, were infested with a small red mite, which also infests the Tarnished Plant Bug.

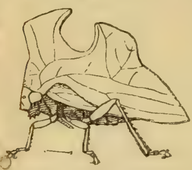


FIG. 25. *Entilia sinuata*: adult—enlarged (original).

Almost every colony was guarded by one or more ants. One colony consisted of many larvæ and perfect insects, each group guarded by medium sized ants, which were all black, except the central portion of the body, which is brown. When I raised a leaf to examine closer the ants gave battle and bit my finger. I gently drew them away, when every insect, perfect and larvæ, began to scatter with astonishing alacrity all over the plant. The ants returned and "rounded them up" exactly as a collie does sheep, placing one ant as guard if the colony was small, more if large. When one strays away an ant at ones goes after it, and with infinite patience gently drives it home again. They constantly pat and press them with their antennæ as they do the Aphides. I have numbers of Aphides in my garden almost deserted by ants, which assiduously attended them before the Entilia hatched. When the larvæ split on the back the ants supervise the process, seeming to peel the empty larval case off. When the insect emerges one or more ants anxiously tend it, passing their antennæ over it repeatedly. I "cut out" a newly hatched Entilia and it at once made for the upper side of the leaf. Very few are ever found on the upper side of a leaf. An ant was detailed to bring it back, which it finally did. It then stayed with the rest. Immense numbers of *Entilia sinuata* were present about one hundred feet away, and these were tended by medium sized black ants. A very large ant-hill is in the center of this flower garden. I believe they attract or introduce Aphides to the vicinity of their abode. These were arrant cowards, and when touched dropped some five or six feet to the ground; otherwise they conducted themselves like their black and brown relatives. Twenty minutes afterward the Entilias were quiet and the ants on guard. When one considers the fact that *Entilia sinuata* in perfect form can both fly and jump—had one jump four feet and fly ten feet from my hand this evening—the control that the ants maintain over them is remarkable. In fact, as I told the hired man (who patiently listens to all the new "old facts" I discover), Solomon knew what he was talking about when he said: "Go to the ant, thou sluggard; consider her ways and be wise." I am fully convinced both from observation and reading that ants have reasoning powers.

I have found *Entilia sinuata* quite plentiful in woods on the underbrush, also on different species of flowers. They suck the juices from

the ribs and veins of the leaves and in small numbers do no harm. There are thousands of them on the flowers in my garden. They would, no doubt, spread over the garden were it not that the ants do not allow them to roam. Two ants were watching about a dozen full-grown Entilias and when I drove them away the Entilias hopped and flew off "forty ways for Sunday," reminding me of a flock of school children when school is out.

Have only found it breeding on Spikenard, *Aralia racemosa* (?).

THE FOOD PLANTS OF SOME JAMAICAN COCCIDÆ, (II).

By T. D. A. Cockerell, *Kingston, Jamaica.*

The present paper continues a series of records commenced in Insect Life, vol. v., pp. 158–160. The numbers of genera not previously listed continue on from the last there mentioned; but genera previously listed, whether or not the species is the same, have their old numbers, with a letter added.

(24) *Aralia guilfoylei* (Araliaceæ).—At the Parade Garden, Kingston, March 1, had a few *Aspidiotus articulatus* and *A. personatus* on the upper side of the leaves.

(25) *Apeiba tibourbou* (Tiliaceæ).—At the Parade Garden, Kingston, March 1, had some *Aspidiotus personatus* and many *A. articulatus* on upper side of leaves.

(26) *Coffea* (Rubiaceæ).—A few *Aspidiotus articulatus* were found on leaves of Coffee sent by Mr. W. W. Wynne from Brokenhurst, Mandeville.

(27) *Cupania edulis* Camb. (Sapindaceæ).—A small akee tree in Kingston, December 18, had on upper side of leaves a few *Aspidiotus articulatus* and *A. personatus;* and on midrib, petiole, and stem many *Planchonia* (*Asterodiaspis olim*) *pustulans*, Ckll.

(28) *Erythrina umbrosa* (Leguminosæ).—At the Parade Garden, Kingston, March 1, had *Aspidiotus personatus, A. articulatus,* and *Ceroplastes floridensis* on the upper side of the leaves.

(29) *Guaiacum officinale* L. (Zygophyllaceæ).—On a lignum-vitæ tree in Kingston, February 1, I found an adult and a young scale of *Ceroplastes cirripediformis*, 3 or 4 *C. floridensis*, and one adult *Lecanium oleæ*. On January 29, I found one scale of *Aspidiotus articulatus* on a small lignum-vitæ tree in Kingston, but most of the *Aspidioti* on the tree, at least, were *A. aurantii.*

(30) *Hibiscus purpureus f. semi-plena* Hort. (Malvaceæ).—At the Parade Garden, Kingston, March 1, had a few *Aspidiotus articulatus* on upper side of leaves.

(31) *Hippeastrum equestre* (Amaryllidaceæ).—At the Parade Garden, Kingston, March 1, had on upper side of leaves one *Lecanium oleæ,* and several specimens of an oval moderately convex red-brown *Lecanium* which can by no means be separated for *L. hesperidum* L.

(32) *Latania aurea* (Palmaceæ).—At the Parade Garden, Kingston, March 1, had on upper side of leaves a few *Aspidiotus personatus.*

(14b) *Musa* (Musaceæ).—In Kingston I found one specimen of *Aspidiotus palmæ* on a leaf. It proved to be infested by a minute brown hymenopterous parasite, having pointed wings with an enormous fringe, tibiæ spurred, tarsi apparently 4-jointed, with last joint longest. This parasite can not well be identified, as it had not emerged from the scale, and I only found it in a fragmentary condition when ex-

amining the host after immersion in soda. It is interesting to find that this *A. palmæ*, though away from its normal food-plant, was either followed by one of its parasites or attacked by one that preys on other Diaspinæ which infest the Banana.

(33) *Melicocca bijuga* L. (Sapindaceæ).—In Kingston I find on the upper side of leaves of Genip, *Ceroplastes floridensis*, *Aspidiotus personatus*, and *A. articulatus*.

(34) *Phœnix dactylifera* (Palmaceæ).—A tree in the Parade Garden, Kingston, March 1, was very much infested by the fungus *Graphiola phœnicis*, which seems to prevent Coccids from attacking the tree. I found only some *very young* scales, apparently *Aspidiotus articulatus*.

(35) *Sabal* (Palmaceæ).—*S. palmetto* and *S. umbraculifolia* at the Parade Garden, Kingston, March 1, had a few *Aspidiotus articulatus* and *A. personatus* on the leaves.

(36) *Theretia neriifolia* (Apocynaceæ).—At the Parade Garden, Kingston, has *Aspidiotus personatus* and *A. articulatus* on upper side of leaves.

(23b) *Vitis vinifera* L. (Ampelidaceæ).—On a grape-vine in Kingston I found a little colony of *Chionaspis*, ♂ and ♀, infesting the upper side of a leaf. These were no doubt *C. minor* Mask., though I could not find a ♀ to examine, although there were scales. Eggs orange, numerous. ♂ scale rather longer perhaps than usual in *minor*. Many mites among the scales.

(30b) *Hibiscus* (Malvaceæ).—In Kingston I find colonies of *Chionaspis minor*, ♂ and ♀, on upper sides of the leaves. They turn the leaf yellow at the place attacked. The body of an adult ♀ is strongly suffused with verdigris-green, and some of the eggs are verdigris-green. Is this a parasitic growth, like that referred to in "The Microscope," by Jabez Hogg (12th Ed., 1887), p. 605.?

(37) *Bignonia magnifica* (Bignoniaceæ).—A plant growing at Cavaliers, Kingston, presents one scale of *Aspidiotus articulatus* on upper side of a leaf; on the under sides of the leaves are a few *Aspidiotus ficus*, and plenty of *Pulvinaria cupaniæ* Ckll., with *Diplosis* pupa-shells projecting from the ovisacs.

(38) *Calotropis procera*, R. Br. (Asclepiadaceæ).—A plant at the Parade Garden, Kingston, September (Da Costa), has a very few *Aspidiotus personatus* on upper side of leaves; but on the stems very many *Diaspis lanatus* Ckll.

(39) *Jasminum pubescens* (Jasminaceæ).—At the Parade Garden, Kingston, September (Da Costa); on upper side of leaf a great many *Aspidiotus personatus*, with a few *A. ficus*, and one or two *A. articulatus*. On under side of leaf, a few *A. personatus*. On the stem, *Aspidiotus* n. sp., and bright red mites with very long hairs at the ends of first pair of legs.

(39b) *Jasminum sambac*.—At the Parade Garden, Kingston, September (Da Costa); on upper side of leaves many *Aspidiotus articulatus;* on under side specimens of a small pale brown *Lecanium*, which, although differing a little from the usual form in appearance, can only be referred to *L. mangiferæ* Green, on account of their blunt-pyriform or subtriangular shape, and the branched hairs round the margin. With reference to this and the last host-plant it is interesting to note that two plants of the same genus, from the same garden, are not affected in the same way by Coccidæ.

(40) *Lawsonia inermis* (Lythraceæ).—At the Parade Garden, Kingston, September (Da Costa); on upper side of leaves, many *Aspidiotus articulatus* and *A. personatus;* on under side of leaves, 2 black *Aleyrodes* scales, 2 *Aspidiotus ficus*, and 1 *A. personatus*. I also found on the leaves some young individuals of *Ceroplastes*.

(41) *Psidium guava* Radd. (Myrtaceæ).—On a guava tree in Kingston, January 29, I found *Dactylopius longifilis*.

(42) *Gossypium barbadense* L. (Malvaceæ).—On February 26, in Kingston, I found many *Dactylopius virgatus* Ckll. n. sp. on under sides of leaves of Cotton. Two males were found; the ♂ of this species appears brown examined after death by transmitted light, but seen alive it is dark olive-gray, with the caudal filaments white, and the wings shining iridescent red-purple. *D. virgatus* occurs on several plants in Kingston, and is a very destructive species. The ♀ has fairly long caudal filaments, but lacks the lateral filaments of *longifilis*. A full description of it will be published elsewhere.

(43) *Viola* (Violaceæ).—In March, 1893, Mr. Nuttall brought me a loaf of white violet from Halfway Tree, with *Dactylopius virgatus* infesting the under side at the base. The specimens were very strongly banded.

(44) *Cycas media* (Cycadaceæ.)—Plants in Castleton Gardens (Campbell) were badly infested by *Diaspis lanatus* Ckll.

(45) *Argyreia speciosa* (Convolvulaceæ).—A plant in Dr. Strachan's garden in Kingston had *Diaspis lantatus* in abundance on the stem.

(46) *Pelargonium* (Geraniaceæ.)—A plant at Cinchona (Harris) was badly infested by *Diaspis lanatus*. I at first supposed these scales to represent a species distinct from *lanatus*, but have quite abandoned this view on further study.

(30c) *Hibiscus* (*Abelmoschus*) *esculentus*.—Plants in Castleton Gardens (Campbell) were badly infested by *Diaspis lanatus*. At first I also thought this was a distinct species, but am now persuaded that it is only *lanatus*.

(47) *Solanum tuberosum* (Solanaceæ.—On a potato stem from Farm House, Pedro (J. Richard Reece), I found a ♀ of *Orthezia insignis* with several young.

(48) *Mentha* (Labiatæ.)—On a garden mint gathered in Kingston by Mr. Hall were many *Orthezia insignis*, and also a few very young specimens of some *Lecanium* or *Pulvinaria*.

(49) *Verbena* (Verbenaceæ).—Mr. Nuttall tells me that at Halfway Tree he finds *Orthezia insignis* infesting Verbena.

(50) *Myosotis* (Boraginaceæ.)—I learn from Mr. Nuttall that *Orthezia insignis* also infested Myosotis at Halfway Tree.

(21b) *Punica granatum* L.—In the garden of the Museum, Kingston, I find several *Ceroplastes floridensis* on leaves of Pomegranate.

(17d) *Mangifera indica* L.—In Kingston, January, 1893, I found *Ceroplastes floridensis* on leaves of Mango.

OBSERVATIONS ON SOME HYMENOPTEROUS PARASITES OF COLEOPTERA.

By F. H. Chittenden.

The following notes are the result of personal observations made by the writer mainly before becoming connected with Government work at Washington, and are supplementary to the records, by Prof. Riley and others, as published from time to time in previous volumes of Insect Life.

ICHNEUMONIDÆ.

Ephialtes irritator Fabr. was reared from its larvæ found living externally on the larvæ of the Cerambycid, *Liopus variegatus* Hald., breeding under the bark of the Box-elder, *Negundo aceroides* (*Acer negundo*). Larvæ were found in the vicinity of Washington, D. C., May 24. Within four days thereafter they had spun their cocoons, grouping them together with two old empty cocoons of the previous year's brood. These cocoons were at first white, but in a few days slowly began assuming a darker brown hue. June 2 the first pupa was found, and June 5 the first imago, a female, appeared, and in a day or two had liberated herself by gnawing through the cocoon. This insect has been previously bred from an unknown Cerambycid under

the bark of Oak, as shown by the records of the Division, published in INSECT LIFE (vol. III, p. 461).

BRACONIDÆ.

Bracon simplex Cress. The cocoons of this species were of quite common occurrence in the nests constructed by, and characteristic of, *Rhagium lineatum* under the bark of white and pitch pine trees, within which the beetles undergo their transformations. Parasites reared at Ithaca, N. Y., in confinement under nearly natural conditions, issued from May 19 to June 11, and specimens were captured flying about pine logs at a later date. This species has been also reared in the Division from an unbred Cerambycid under oak bark, as recorded in INSECT LIFE, vol. II, p. 348, and by Mr. A. D. Hopkins from wood of Beech and Spruce infested by Cerambycidæ and Buprestidæ (l. c., vol. IV, p. 256).

Bracon eurygaster Brullé was bred from small branches of Quince that had been amputated by *Elaphidion villosum* Fab. the only other species reared from this wood. Also reared under similar conditions by Mr. Hopkins, from elm wood infested by an unknown Longicorn (l. c., vol. IV, p. 257). South Woodstock, Conn.

Bracon erythrogaster Brullé was reared from hickory wood infested almost exclusively with *Cyllene picta*. Specimens were also taken under the bark of Oak where they were probably parasitic on some other common Longicorn. Ithaca, N. Y.

Doryctes radiatus Cr. was bred from flattened cocoons similar to those of Bracon found under the bark of newly felled hickory wood infested with *Cyllene picta*, on which species it is doubtless parasitic. Imagos emerged in June. Specimens were also taken in the field, May 26. Ithaca, N. Y.

Cœnophanes dinoderi Ashm. MS. bred out from some pieces of dead oak wood together with the Ptinid, *Dinoderus punctatus*, the only other species found. The beetles were extremely abundant; the parasites were rare. Date of emergence not noted. Flatbush, L. I.

Cœnophanes utilis Cr. was reared from larvæ of *Liopus cinereus* Lec., found boring the twigs of Locust (*Robinia pseudacacia*). All stages were taken April 21, one adult already dead. The first pupa was seen May 8; this prepared to transform May 22 and the adult insect was found May 25. One larva transformed to pupa as late as June 10. Many of these Cerambycid larvæ were parasitized. Ithaca, N. Y.

Helcon dentipes Brullé was bred from chestnut wood infested by a small Longicorn, supposed to have been *Callidium æreum*, also from wood from which were reared *Rhopalophora longipes* and *Curius dentatus*. These Longicorns belong to the same sub-family, the *Cerambycinæ* and the Hymenopteron might be parasitic on all three species.

Cenocœlius rubriceps Prov. is an external parasite of *Liopus cinereus*. It was reared from the latter found breeding in the twigs of Locust

This species occurred with, but was not so abundant as, *Cœnophanes utilis* Cr., the parasite of *L. cinereus*, previously mentioned.

Meteorus orchesiæ Ashm. was bred from whitish cocoons in old dry wood of Birch (*Betula*), infested with the Cistelid, *Mycetochares binotata.* Imagos developed during the first week of May, Ithaca, N. Y. As a considerable number of individuals of both parasite and Coleopteron were bred, and no other insects were present in these twigs, I have no hesitation in placing Mycetochares as the host of this parasite, especially since the type of the species was bred from Orchesia—a genus of a very closely allied family—as recorded in an editorial article in INSECT LIFE, vol. III, p. 57.

Euphorus phlœotribi Ashm. is an internal parasite of the adult of *Phlœotribus frontalis*, having been reared from pieces of the wood of the White Mulberry (*Morus alba*) infested by this Scolytid. Although only a single example of the parasite was obtained this rearing is of much interest, for an examination of the galleries of the beetle resulted in the discovery of an empty, whitish cocoon and a dead beetle which had been parasitized, a circular hole near the end of its elytra showing where the Hymenopteron had issued. This species is thus shown to conform closely in habit to the congeneric *sculptus* Cr., a common parasite of the adult *Megilla maculata*, which has been treated by Dr. Riley in vol. I of INSECT LIFE (pp. 101, 338). It is probable, judging by the size of the species under consideration compared with its host, that the latter dies before or soon after the issuance of the parasite. Alexandria County, Va.

CHALCIDIDÆ.

Homalotylus obscurus How. was reared by me from three different species, representing as many genera of Coccinellidæ. Three examples were bred from larvæ of *Coccinella 9-notata.* The infested larva had attached itself for pupation about September 20, and the adult parasites emerged in October. Spring Lake Beach, N. J. A number of these parasites were also bred from the larva of *Psyllobora 20-maculata* taken with uninfested larvæ and the pupæ and imagos of the same at Ithaca, N. Y., October 3 on the European Ash. Adult parasites issued from April 24 to May 16 and earlier. Only a single parasite was bred from each Coccinellid larva as far as could be ascertained. A third rearing was from *Mysia pullata*, a ladybird confined almost exclusively to pine trees and other Coniferæ. Eleven examples, an exceptionally large number, were reared from a single larva, taken May 24, attached to a pine needle. Each of these eleven parasites had, as in the first case, issued from a separate hole in the body of the host. Other parasitized larvæ were also seen.

This insect was described from specimens bred by Mr. H. G. Hubbard from larvæ supposed to have been those of *Coccinella sanguinea* (Bulletin No. 5, Division of Entomology, p. 22). Subsequently Mr.

Hubbard reared specimens from *Hippodamia convergens* (Insects affecting the Orange, Division of Entomology, p. 74). As far as observed this species, the sole North American representation of the genus, infests only Coccinellid larvæ, but a congeneric European species has been found to prey upon Galeruca of the family Chrysomelidæ.

Eupelmus cyaniceps Ashm. was reared from the seed pods of the False Indigo (*Amorpha fruticosa*) which were inhabited exclusively by *Bruchus exiguus* Horn. Adults issued at Washington, D. C., during the early part of October. This insect is by no means rare and it seems a little singular that it, or an allied species, has not been recorded from the congeneric species, the Pea and Bean Weevils.

Another species of Eupelmus issued from apple twigs from which was also reared the injurious Fruit Bark-beetle, *Scolytus rugulosus*, the only other species bred. Port Richmond, Staten Island. This species seem to be extremely rare.

Catolaccus tylodermæ Ashm. A pair of these parasites, male and female, were reared in September from the pupal chambers of *Tyloderma foveolatum*, but whether from the larvæ or pupæ could not be ascertained. In order to effect their exit they were obliged to cut through the stem which is of about the consistency of the average perennial of the same size, and about 0.10 inch thick at the point of exit. The cells of each could be readily distinguished by the exit holes, that of the male being appreciably smaller. District of Columbia. It is quite possible that this species may also parasitize the noxious *Tyloderma fragariæ*, or Strawberry Crown-borer.

PROCTOTRYPIDÆ.

Anoxus chittendeni Ashm. was bred from Polyporus, a genus of tree fungus, inhabited by *Cis fuscipes*, and is without doubt parasitic on this beetle, since no other insects were present at the time of this rearing. Ithaca, N. Y.

Cephalonomia hyalinipennis Ashm. was reared under precisely similar conditions to the above from twigs of Fig (*Ficus indica*) growing on the grounds of the Department of Agriculture. These twigs were infested exclusively with the little Scolytid, *Hypothenemus eruditus*, which with the parasite occurred in abundance in burrows in the pith in October.

Quite a number of other species have been reared from wood, but under such circumstances that it has been found impossible to determine the host. Doubtful cases have not, therefore, been considered, and I feel reasonably certain that the rearings here mentioned are worthy of record, although the host insect has not been, in all cases, identified with absolute certainty.

In most cases the parasites under observation were kept under practically normal conditions, and the breeding dates given are therefore nearly as in nature.

The parasitic species mentioned in this paper were determined for me by Mr. W. H. Ashmead, and by comparison with types in the National Collection. Types of the new species are also in the National Collection.

REPORT ON THE AUSTRALIAN INSECTS SENT BY ALBERT KOEBELE TO ELLWOOD COOPER AND B. M. LELONG.

By D. W. Coquillett.

Los Angeles, Cal., *November 1, 1892.*

Sir: In accordance with your letter of October 11, 1892, instructing me to examine and report upon the condition of the colonies of beneficial insects sent from Australia by Mr. Albert Koebele to various persons in California other than myself, I submit herewith the following brief report.

Respectfully,

D. W. Coquillett,
Special Agent.

Prof. C. V. Riley,
Entomologist.

On the 21st of October I interviewed Mr. Koebele at his home in Alameda, and learned from him that besides sending insects to me he had also sent some to Mr. Ellwood Cooper and to Mr. B. M. Lelong. Those sent to the former had been liberated in the olive grove formerly owned by Mr. Cooper, near Santa Barbara, while of those sent to Mr. Lelong, colonies had been sent to each of the following localities: Alameda, Haywards, Santa Clara, San Gabriel (two), Orange (two), and Tustin (two), making nine colonies in all.

Mr. Koebele informed me that the colony sent to Alameda by Mr. Lelong was placed in Mr. Koebele's yard upon a pear tree thickly infested with *Aspidiotus perniciosus.* This colony was placed upon the tree about the middle of May, and consisted of about forty adult specimens of *Orcus chalybeus*, five *Orcus australasiæ*, and two specimens of an undetermined species of Rhizobius. In company with Mr. Koebele and two other entomologists, Messrs. Baron and Harford, I examined the tree upon which this colony had been placed, and also the adjoining trees, but none of us found any trace of the *Orcus chalybeus*, and Mr. Koebele informed me that he had never succeeded in finding it upon these or any of the other trees in that vicinity, although he had repeatedly searched for it, since his return from Australia in August. Of *Orcus australasiæ* we found two adults, two pupæ, and seven larvæ, and of the Rhizobius we found two adults and six larvæ. One of the Rhizobius adults was found upon a tree adjacent to the one upon which the colony had been placed, but all of the *Orcus australasiæ* were upon the original tree.

In the afternoon of the above-mentioned day I proceeded to Haywards, in Alameda County, and interviewed Dr. E. Kimball. From

him I learned that about the middle of May Mr. Lelong had erected a cloth tent over one of his lemon trees quite thickly infested with *Lecanium oleæ*, and had introduced about a dozen moths of *Thalpochares cocciphaga* into this tent. About the 1st of October the tent was removed, and at that time no trace of these insects could be found upon this tree. Dr. Kimball informed me that about two months ago Mr. Lelong liberated several of these moths in his orange grove, and that about the middle of May he had liberated several adults of *Orcus chalybeus* in the same grove. Mr. Koebele informed me that he had liberated in this grove the moths of *Thalpochares cocciphaga* brought with him from Australia in August. I did not succeed in finding a trace of any of these insects, and Dr. Kimball informed me that he has not been able to find any of them in any of their stages. While at Alameda, Mr. Koebele informed me that he had carefully examined this grove about three weeks previously, but had been unable to find any of the imported insects in any of their stages.

On the 22d of October I proceeded to Santa Clara, in Santa Clara County, for the purpose of investigating the colony of insects sent by Mr. Lelong to Mr. A. Block. Mr. Block was absent, but his foreman informed me that a colony of *Orcus chalybeus* had been placed upon one of his pear trees infested with *Aspidiotus perniciosus.* I was not able to find a trace of this Orcus upon any of the trees.

On the 28th of October I called upon Col. J. R. Dobbins, of San Gabriel, in Los Angeles County, and learned from him that about the middle of May he had received about a dozen adults of *Orcus chalybeus* from Mr. Lelong and had placed them upon one of his lemon trees thickly infested with *Aspidiotus citrinus;* but neither of us was able to find a trace of the Orcus upon this or upon any of the adjacent trees, and Mr. Dobbins informed me that he has never found this insect in any of its preparatory stages in any part of his or of the neighboring orange and lemon groves.

In company with Mr. Dobbins I next visited Mr. A. Scott Chapman, near San Gabriel, and learned from him that during the first half of July he had received from Mr. Lelong a colony of about one hundred and fifty adult specimens of *Orcus chalybeus* and a single specimen of *Orcus australasiæ;* these he had placed upon one of his lemon trees infested with *Aspidiotus citrinus*, but neither myself nor Mr. Dobbins was able to find a trace of them upon this or any of the adjacent trees, and Mr. Chapman informed me that he has never found these ladybirds in their early stages upon any of his trees.

On the following day I visited Mr. H. K. Snow, of Tustin, in Orange County, and learned from him that during the last half of February he had received from Mr. Lelong about forty adult specimens of *Orcus chalybeus* and two specimens of *Leis conformis.* These he had placed on one of his orange trees thickly infested with *Aspidiotus aurantii;* but neither of us was able to find a trace of the imported insects either

upon this or upon any of the adjacent trees, and Mr. Snow informed me that he had never found these insects in their early stages upon any of his trees.

From Mr. Snow I learned that a colony of about thirty adult specimens of *Orcus chalybeus*, received from Mr. Lelong at the same time that Mr. Snow had received his, had been placed upon an orange tree in the grove of Mr. S. W. Preble, near Tustin. Mr. Preble was absent, but his foreman showed me the tree upon which the colony of imported insects had been placed. I was not able to find any of these insects either upon this or any of the adjacent trees.

I next visited Mr. Hiram Hamilton, of Orange, in Orange County, and learned from him that he had received two colonies of imported insects from Mr. Lelong. The first colony was received during the last half of February, and consisted of six specimens of *Orcus chalybeus* and a single specimen of an undetermined Scymnid. These he placed in a glass jar and supplied them with *Aspidiotus aurantii* to serve as food, but they finally died without depositing eggs. The second colony reached him during the first half of July, and consisted of about seventy specimens of *Orcus chalybeus*, two *Leis conformis*, and six specimens of an undetermined Scymnid. These were placed upon an orange tree thickly infested with *Aspidiotus aurantii*, but neither Mr. Hamilton nor myself was able to find any trace of them either upon this or any of the adjacent trees, and Mr. Hamilton informed me that he had never found either the larva or pupa of any of the imported insects upon any of these trees.

This completed my investigation of the imported insects received and sent out by Mr. Lelong. Of the nine colonies of *Orcus chalybeus* thus sent out by him, not a trace of a single one of them can be found at the present time; and out of the entire number of colonies of insects, only one—that at Alameda—has succeeded in maintaining itself up to the present time.

On the 26th of October, in company with Mr. John Scott, the Horticultural Commissioner of Los Angeles County, I paid a visit to Mr. Ellwood Cooper, near Santa Barbara, and learned from him that he had received two colonies of the imported insects from Mr. Koebele. The first colony was received during the first half of June, and consisted of about two dozen specimens of *Orcus australasiæ* besides a few specimens of an undetermined species of Rhizobius. The second colony was received during the first half of July, and consisted of about four hundred specimens of *Orcus australasiæ* and *Orcus chalybeus*, principally the former, also a few specimens of the Rhizobius and a box containing the larvæ and chrysalides of *Thalpochares cocciphaga*. The latter was placed in an olive tree infested with *Lecanium oleæ*, the lid of the box having first been removed and a piece of wire-screen placed over the box, the meshes in this screen being large enough to admit of the escape of the moths. The remaining insects were liberated among some

olive trees infested with *Lecanium oleæ.* In company with Mr. Cooper, Mr. Scott, and Dr. H. Sidebotham, who has charge of this ranch, I examined a large number of the trees where these imported insects had been liberated, and together we succeeded in finding about fifty-four adults, twenty pupæ and three larvæ of *Orcus australasiæ;* thirty adults and eight pupæ of *Orcus chalybeus;* and about nine adults of the Rhizobius. No trace was found of the Thalpochares, and both Mr. Cooper and Dr. Sidebotham informed me that they have not been able to find this insect in any of its early stages.

This completed my examination of the insects sent over from Australia to Messrs. Cooper and Lelong by Mr. Koebele. Besides at Los Angeles, *Orcus chalybeus* is also established at Santa Barbara; and *Orcus australasiæ* and the Rhizobius at Santa Barbara and Alameda.

THE GENUS DENDROTETTIX.*

By C. V. Riley.

At the meeting of the Entomological Society of Washington, June 2, 1887, I presented specimens of a tree-inhabiting locust which I had studied in all stages in Missouri, and for which I proposed the new genus *Dendrotettix* and the specific name *quercus.* I promised to describe the species at some future meeting, but pressure of other work has hitherto prevented my doing so, though the manuscript name I then proposed has been used and referred to on several occasions. At a subsequent meeting I exhibited specimens from Washington County, Tex., having a similar habit and belonging to the same genus, and which I proposed to characterize as *D. longipennis.* This name has also been used in print, and I therefore take the present occasion to present a characterization of the genus and a description of the latter species, more particularly because Mr. Lawrence Bruner has now issuing from the U. S. Department of Agriculture a bulletin in which he wishes to quote the description.

DENDROTETTIX, gen. nov.

Head moderately large, the face less receding than in Caloptenus, the occiput ascending less and more depressed between the eyes and between the antennæ, giving greater prominence to the median ridges; more deeply sunken into the flaring anterior edge of the pronotum; fastigium moderately depressed in the ♀ and more distinctly so in the ♂; rather deeply sulcate; lateral carinæ quite prominent, somewhat approaching between the upper extremities of the eyes and also in front, where they are continuous with those of the frontal costa which is shallowly sulcate until just below the ocellus where it suddenly becomes much narrower and superficial, gradually fading away; eyes ordinarily more prominent and bulging than in Caloptenus. Pronotum quite broad, slightly narrowed at anterior third, widened posteriorly; posterior margin nearly straight or slightly rounded, with a very slight excavation at the median ridge; front margin extending over the occiput; the transverse impressed lines are deep, distinct, and continuous, the anterior

* Read by title before the Entomological Society of Washington, March 9, 1892.

crossing at rather less than one-third of the space, the second more irregular, just behind it, and the third reaching not quite to posterior third of space. Disk of posterior lobe nearly flat and strongly granulate, the lateral angles rather sharp. Tegmina and wings of equal length extending, when fully developed, beyond the tip of the abdomen in both sexes, the former rather narrow at the base but broadening especially at their apical half, the apex being evenly rounded; edges of tegmina not meeting when at rest at base, in the ♀, but overlapping beyond basal third. Hind femora rather slender, not quite reaching the tip of the abdomen (♀) or slightly surpassing it (♂); the anterior and middle femora but slightly enlarged in the ♂; hind tibiæ rather slender, quite hirsute, and with the spines long, regular and sharp. End of male abdomen not enlarged, but very generally bent upwards; supra-anal plate subtriangular, with very pronounced depressions, which leave marginal ridges and a medio-dorsal anteriorly furcate ridge, also a transverse median ridge somewhat arched anteriorly; anal cerci flat, about twice as long as wide, the apical portion slightly twisted and the apex evenly rounded. Valves of the ovipositor short with the outer emargination of the upper pair slightly serrate. Prosternal spines stout, short, pyramidal, and directed but slightly backward.

The genus is noticeable, as genera are made in the Acridiidæ, by the wide, greatly depressed and broadly sulcate vertex, the short and rather broad pronotum, the slender legs and tapering abdomen. These features, together with the rather bright coloring of the species, bring it near to some southern or subtropical forms like Rhomalea.

DENDROTETTIX LONGIPENNIS n. sp.—General color testaceous with slight olivaceous hue, varied with faint yellow and piceous bands and lines; face dull olivaceous brown; occiput, especially back of the eyes, darker. Pronotum olivaceous with more or less yellow; median carina and the transverse impressed lines on the lateral bands piceous, generally darkest and most continuous in the ♂. Tegmina dull olivaceous brown, the veins being testaceous and giving the basal half a decidedly lighter coloring. Wings rather dark, becoming somewhat pellucid near their base, the veins dusky, especially on their apical half. Posterior femora with their outer face dull olivaceous and marked with brown and black along their upper edges and crossing to the inner surface, which, with the lower sulcus, is bright sanguineous, this coloring showing through the somewhat transparent walls even on the outside; the apex black, preceded by a rather wide and very distinct lemon-yellow annulus; hind tibiæ with a wide post-basal annulus of the same bright color; anterior and middle legs, also the tarsi of the hind legs gamboge-yellow, with the spines and claws black; antennæ fuscous, olivaceous towards tip. Venter gamboge-yellow.

Average length ♂ 25^{mm}, ♀ 30^{mm}.

The short-winged forms agree in all other respects except that, as is the case with other genera, the tegmina do not ordinarily extend much beyond the second abdominal joint, and may be either perfectly rounded or slightly twisted at the apex. In some cases, however, they extend to one-half the length of the abdomen.

Described from 2 ♂♂ and 3 ♀♀ of the long-winged form, and 4 ♂♂ and 7 ♀♀ of the short-winged form. Received from Mr. E. H. Hill, Manor, Travis County, Tex., July 13, 1887, as injuring post oaks; also collected by Mr. Bruner.

Mr. Bruner gave an account of the habits of this species in 1887, under the name of the Post Oak Locust (Bull. 13, Ent. Div. U. S. Dept. Agric., pp. 17–19), from his observations in Texas. Dr. Packard quotes this account entire under the name *Dendrotettix quercus* Riley MS. (5th Rep. U. S. Ent. Comm., 1890, pp. 214, 215), while in a paper before the Association of Economic Entomologists (*Can. Ent.*, vol. XXIII, p. 191, Sept. 1891, and INSECT LIFE, vol. IV, p. 20, Oct. 1891). Mr. Bruner

refers to it under the name *D. longipennis*. The species which I have referred to as *quercus* and which was found in St. Louis County, Mo., in 1877, feeding on Oak, is considered specifically distinct by Mr. Bruner. Six females and two males are before me, and, while they show average smaller size and paler coloring and no long-winged specimens have yet been found, I should hesitate to consider this Missouri form more than a variety; so that I would designate it *D. longipennis*, var. *quercus*.

EXTRACTS FROM CORRESPONDENCE.

Color of a Host and its Relation to Parasitism.

I have conversed with a number of intelligent stock-raisers, who declare that color has nothing to do primarily with the attacks of flies of various kinds on cattle, and explain the curious fact by saying that animals with very thin skins are at once chosen by flies. We have two yokes of dark red oxen. One of these will be covered with flies, owing to his extremely thin skin, while his "yoke fellow" will be comparatively free. Second, some animals' nervous systems are more highly developed, therefore they are more susceptible to annoyance. Horsemen are all aware that sorrel horses are "higher strung" than any other color, and are much annoyed by insects. Third, wounds and abrasions at once attract hordes of flies. Horsemen have always told me that gray or white horses were, in jockey parlance, "tougher," than any other color. Still I have heard that white horses alone were subject to a kind of cancer called Melanosis. As to white chickens being more subject to gapes, I have never been troubled with diseases among my fowls. I have never raised many white chickens, but my neighbor, Mrs. Cosky, has raised white Leghorns for years, thousands of them, and finds them peculiarly hardy and healthy; not troubled with gapes at all.—[Mrs. M. E. Rice, Pennsylvania.

Fowls and Toads vs. Garden Insects.

I see in INSECT LIFE, vol. IV, p. 76, a note concerning ducks and the Colorado Potato-beetle. Permit me to add my experience concerning fowls as insect exterminators. While it is true that ducks, under some circumstances, will acquire a taste for the beetle, still you can not "bet on it." They are just as apt to destroy produce to more than balance the account. My aunt having read in the *Rural New Yorker* a similar account, she placed about a dozen in her garden. Hearing her complain of something destroying her cucumbers, a careful examination proved that the ducks were the culprits.

In my own case, they destroyed all my water-cress, and pulled down a great deal of grain, wheat, oats, and buckwheat; were always soiling the spring and spring run and spoiling our neighbors' tempers; they will follow a run for two miles. This summer a neighbor's ducks, twelve in number, destroyed a good deal of buckwheat for us. There were plenty of potato-beetles handy, but they did not touch them. I have given up raising ducks unless I can have a good-sized fenced pasture for them near water. When the potato-beetles first appeared my husband scattered buckwheat between the rows and called the chickens after him as he shook down the beetles and tiny larvæ among the buckwheat on the ground, soon the fowls would pick off the insects for themselves.

As to chickens, one year we put our Early Rose potatoes near the barn. For fear of hurting the chickens we did not use Paris green, as usual. My husband soon discovered that our chickens kept the beetles in check (see note). I did not believe this, so I made careful examination of plot (an acre in extent); I did not find a

hundred beetles and very few larvæ, but did see the hens and chickens; the rooster, a fine Langshan, at their head, ate the tiny larvæ. To be sure, they did eat some potatoes, but who would mind such a trifle? Next season we put in a large patch of potatoes near the henhouse, adjoining a large cabbage patch. Now, early cabbage brings here five or six cents per pound. I had intended making my fortune that year on "Early Jersey Wakefields." They had begun to head very nicely. I noticed the rooster and his numerous family walking up and down the rows; my husband suggested that they were worming the cabbage. I investigated; they had not touched the potato beetles apparently, but had eaten the hearts out of over one hundred cabbages. I sold the fowls the next day, all but the roosters, whom I took real satisfaction in consigning to the pot. I was damaged to the tune of twenty-five dollars.

I have decided that turkeys and Guinea fowls are the only fowls that can be trusted in a garden. Turkeys sometimes damage grain, but can be watched; they destroy innumerable grasshoppers.

But toads are the birds, as our Irish neighbor says: I even think it would pay to put a 12-inch board around market and flower gardens and introduce toads, they make nice pets (we have a big black one that has lived under the porch for years) and destroy immense numbers of injurious insects.

By the way, sprinkling the ground with a solution of Paris green (level teaspoonful to 16 quarts of water) seems to materially reduce the leaf-hoppers, flea-beetles, etc., that infest our garden. But thorough cultivation and plenty of manure—commercial as well as barnyard manure, will place any crop beyond the reach of any but extraordinary insect depredation.—[Mrs. M. E. Rice, Pennsylvania.

Bisulphide of Carbon against Grain Pests; Additional Correspondence.

* * * The bisulphide of carbon vaporizes so rapidly that we do not understand how it can be effective for more than a few days at a time unless the crib is practically air-tight.

My experiment on the evaporation of the bisulphide of carbon at a temperature of 90° to 100° degrees F. are as follows:

I filled five one-ounce vials with the carbon, and placed them in a row in a warm room.

Vial No. 1. Without any covering. Fluid evaporated in three days.

Vial No. 2. Covered with two layers of fine muslin. Evaporated in six days.

Vial No. 3. Covered with four layers of fine muslin. Evaporated in 5¾ days. May have been some defect in tying.

Vial No. 4. Tightly corked with a pipe-stem through the cork, running almost to the bottom of the vial. In half an hour the gas forced the fluid to the top of the tube, but never ran over. Evaporated in three days.

Vial No. 5. Covered with a thin sheet of gum elastic, and perforated once with a very fine needle. Evaporated in ten days.

In these experiments the evaporating surface of each vial was about three-fourths of a square inch. Of course, as the size of the surface is increased, there would be an increase of evaporation, a matter to be observed for practical purposes.

Experiment No. 5 has agreeably disappointed me, for I expected that the evaporation would be exhausted somewhat within the range of six days.

For weevils our remedy is fully reliable, but for the exclusion of mice and rats the vapor should be kept up, if not continuously, at least at short intervals.

I have concluded to treat this year my corn in the bin as proposed in my last letter, with half-pound bottles of the bisulphide of carbon, covered with two layers of very close texture of cloth, capped over with a wad of cotton tightly compressed. At least, I will test it shortly as above, with the expectation of prolonging the evaporation a full month, or even longer, within the bin. I would offer reasons to adopt

the plan if time and space would admit, for the subject would call for a great deal of theorizing. The compressed cotton would serve almost like a solid body, as I found a small feather cushion serve as a very efficient stethoscope and ear piece for the telephone. I have an idea that the transmission of the vapor through the cotton from a large bottle would give the best results.—[G. P. Hachenberg, M. D., to Division of Ornithology and Mammalogy, Texas, August 3, 1892.

On Irrigation and its Effects on Insects.

Was much interested in account of effects of irrigation on insect life; as at present I am farming in an irrigated country, and can furnish a little evidence out of the speculative stage. I am at work breaking 320 acres of new land on the west side of Cole Slough. The soil is sedimentary, with clayey subsoil, and liable to crack; very level, a foot levee being sufficient to flood a strip one-half mile wide. When I turned the water on it filled the cracks ahead of the main current, and drove out a perfect horde of scorpions, centipedes, and pocket mice. The scorpions are not as large as those on the east side of the slough, in the sand, which are from four to six inches long, but are scarcely one-half inch long; while the centipedes may be found in all sizes up to six inches in length. These hunt the highest land, and are finally covered over, and as they can not swim, they die.

So much for getting rid of dry soil species; but water brings ten species to one it kills, the mosquito leading the list.

Nevertheless, if the wheat stubble be allowed to soak in it, there will be many grain destroyers held in check, if not kept entirely at bay.—[Alvah A. Eaton, California, February 2, 1893.

A tropical Honey Bee.

I inclose specimens of a local honey-giving bee. Have you it in the States, and what is its name?

Its storehouse or hive is represented by section of trees, to which considerable attention is given. A considerable industry might be locally developed in wax. What are the prospects in the United States? Pray give me any notes or suggestions which may occur to you. Is there a prohibitive tax?—[Sir Alfred Moloney, British Honduras, March 3, 1893.

REPLY.—* * * It is one of the stingless tropical bees of the genus Melipona, and corresponds exactly with Frederick Smith's description of *Melipona fasciculata*, from Para, Brazil, and may without much doubt be identified with this species. It is hopeless to attempt to colonize this bee in the States, as our temperature is too low for it. It will not stand a lower temperature than 50 degrees and, so far as I am informed, its honey is inferior to that of our common *Apis mellifica*. There is, however, no tariff upon wax or upon bees for breeding purposes.—[March 14, 1893.]

A honey-producing Ant.

Some very curious specimens of this pest, and its produce, have lately been sent to the writer, from a little known district in Western Australia, 330 miles inland from the Indian Ocean, and in latitude 27°. They inhabit cells or caves in the sand of the scrub-covered lands of this district. Several large females, or queen ants dwell together in seeming harmony, in each of these caves, never venturing from home to collect the honey, but leaving that duty entirely to the working ants, which bring in supplies from outside and hand them over to the queens, who store the substance away in large oval-shaped bags, or pouches, of the size of from half an inch to three-quarters. As yet no closer observations have been made, but the gentleman who sent the specimens intends to devote some time to the work and report progress. He states that the honey is taken by the working ants from flowers,

as by bees, but it is not improbable that this is only an inference, for since ants are well known to be very partial to the honey-dew secreted by various insects, the sweet substance may prove to be derived from that source.—[R. Allan Wight, Aukland, New Zealand, August 1, 1892.

REPLY.— * * * The honey ant is very interesting. It differs from our *Myrmecocystus melliger* of Colorado. So far I am unable to identify it with the species previously described from Australia, of which, however, I have never seen specimens. Emery, in the Ann. Mus. Civ. Genova, 2, IV, 1887, describes a species from Australia which he calls *Myrmecocystus irridescens*, while I notice in the Gardeners' Chronicle, for November, 1880, that Sir John Lubbock has described a honey-producing species from Australia under the name of *Camponotus inflatus*. * * * Our American species is very similar in form, and the larva is probably practically the same. One form of the worker has its abdomen distended to the size of a currant and entirely filled with grape sugar or "honey." The honey-bearers are found clinging to the roofs of the chambers a few inches under ground and act simply as cells for the storing of the sweet substance, which is collected by the active workers from the exudations of a gall, *Cynips q. mellaria* Riley on *Quercus undulata*. In times of famine the honey-bearer or "rotund" regurgitates the honey drop by drop and it is transferred to the stomachs of the hungry individuals in waiting. In other respects, the economy of the colony does not differ materially from that of other species. It is supposed that the worker majors are transformed by the gradual distention of the crop and expansion of the abdomen into the honey-bearers and that the latter do not compose a distinct caste, although some of the majors may have a special tendency to this change by reason of some peculiar structure of the intestine or abdominal walls.—[September 14, 1892.]

The Jumping Bean again.

The inclosed seeds, from California, when held in the hand exhibit motions that have gained for them the name of jumping seeds. On piercing the shell a live caterpillar was found with seed gone. I would like to know the name of the plant and the insect. It would remain in a dormant state I suppose until the leaves of the same plant were large enough to furnish it food. Can I hope to rear it?—[Mrs. J. M. Hunter, New York, October 26, 1892.

REPLY.—The specimen sent is one of the so-called "Jumping Beans" infested by the larva of a little Tortricid moth known as *Carpocapsa saltitans*. There are three species of plants belonging to the genus Sebastiania, viz, *S. bilocularis*, *S. palmeri*, and *S. pringlei*, the seeds of which are infested by this insect in the United States. The adult insect is a small, grayish moth, and if you keep the seeds you will probably be able to rear some specimens.—[October 27, 1892.]

A Corn Ear-Worm Crusher.

My Heliothis-crushing instrument is not yet made, and I dare not say whether it would succeed. It was (or rather is) to be two wooden butter-pat-like instruments, with a groove down each to admit the convexity of the stalk (but not *too* deep of course), and an arrangement so that they would lock together and give proper leverage.

I give you this information because you ask for it, but likely enough the thing would fail in practice. However, a corn-grower in the country here, to whom I first suggested it, thought it a very good idea. It would in some ways be simpler to have a hinge in front, but that would make it harder to see what one was doing.

The larvæ complained of (of which I received samples) were in the green tops (no ear formed as yet), which I understand they mainly affect. In my own specimens it would be easy to crush the larvæ by pressure which would not injure the corn,

but whether this would hold good in the field I can not tell. Rubber might be put in the grooves if thought advisable. * * *—[T. D. A. Cockerell, Jamaica.

REPLY.—When you have given your Heliothis crusher a practical test please notify me of the result. It really seems to me that one could use his unassisted hand to about as good an advantage. The pressure could certainly be graduated more accurately.

Wax Moths in a Cupboard.

FIRST LETTER.—I send a box of cocoons. I have never noticed them before, but this year they were found in abundance in a cupboard shelf where books and papers were kept. They seemed to have lived on the paper and in forming their chrysalides some gnawed into the hard covers of books and pasteboard boxes.—[Alda M. Sharp, Iowa, December 7, 1892.)

REPLY.—* * * The cocoons which you send are apparently those of the common Honey Moth or "Wax Moth" (*Galleria mellonella*), and I imagine that you may have kept honey in this same cupboard. You will find some account of the insect in Riley's First Report as Entomologist of the State of Missouri (p. 166), where it is mentioned under the name of *Galleria cereana*, by which name it is also treated in most of the works on the Honey Bee.—[December 14, 1892.]

SECOND LETTER.—When I sent you the cocoons I was not aware that honey or wax had been in the cupboard where they were found, but I have since learned that a jar of wax and honey from a hive killed out by moths had been stored there a few days, which solves the riddle.—[Alda M. Sharp, Iowa, December 21, 1892.

On the Habits of some Blister-beetles.

On July 21 I noticed that *Lytta cinerea* and *Lytta marginata* were devouring the *Clematis virginiana*. The two species seemed to be about equally divided. I dusted the vine with Paris green mixed into lime, and the beetles disappeared.

On July 23, I noticed that they had attacked another vine, *Clematis coccinea*. On the 25th I prepared to try these with kerosene emulsion. After having sprinkled about half of them I noticed that the two kinds were mating indiscriminately. I then quit trying to destroy and began to observe. Three pairs while in copulation were bottled, one pair, male *cinerea* with female *marginata*; one pair, male *marginata* with female *cinerea*; one pair male and female *cinerea*. As many as eight cases of cross-mating were observed, with only one of *cinerea* with *cinerea* and not any of *marginata* with *marginata*. It is plain that crossing was preferred.

The Paris green and lime frightened all away from *Clematis virginiana*, and they never returned. The kerosene emulsion lessened the number on *Clematis coccinea*. It was the 20th dilution and killed those only that raised their wings so as to permit the spiracles getting wet. Others were simply knocked off the vine. On August 1 there were a few beetles on *C. coccinea*, some of each kind; but the beets, potatoes, tomatoes, cabbage, pig-weed, and black nightshade of the gardens and Silphium and Actinomeris of the woodland were being attacked by *marginata*. Two of these found in copulation on the potato were bottled. *Lytta cinerea* was found on nothing but Clematis, and all had disappeared by August 10.

The period of vigorous vegetation which precedes and accompanies inflorescence seems to determine what species of Clematis these beetles select as food-plants. They first attacked the late flowering species, as *C. virginiana* and *C. flammula*; these flower in profusion by the first of August, and were when attacked full of tender leaves and flower buds. Their second choice seemed to be those species that flower all summer, *C. coccinea* and *C. viorna*. The early flowerets, as *C. jackmani* and *C. candida*, were not touched, perhaps, because having long passed the flowering stage, the leaves of these species had become harsh and woody.

On August 15 *Lytta marginata* was everywhere abundant. By this time they had stripped the potato tops and were making skeletons of the cabbage leaves, I can safely say, all over Decatur County.

Thirty years ago *Lytta vittata* was *the* "potato-bug." They would attack a potato patch, say of one or two acres, in immense numbers and devour it in a day. Then for a generation it was the "Colorado potato-bug." Now the inheritance seems to have been suddenly handed down to *Lytta marginata*, a beetle that was not common, at least in this locality, ten years ago. However, the damage from *marginata* is not likely to be serious, for early varieties are now in favor and the potato crop is largely matured before the "black potato bugs" make their appearance. A few examples of *vittata* were seen along with *marginata* on the beets, potatoes, and tomatoes.

By September 15 *marginata* and *vittata* had entirely disappeared, and *Lytta murina* had become abundant, especially on the Golden Rod. The first example of *murina* was taken on *Silphium perfoliatum* August 7. On September 25 the golden rods were in their glory and the Black Blister-beetles were the commonest of the many insects that feed upon these flowers. Outliving the golden rods, they took to the asters, and by the middle of October they had entirely disappeared.

The cross-mating of *L. cinerea* and *L. marginata* is an evidence that they are one and the same species. The difference in length of life and in range of food-plants is an evidence that they are distinct species. Experiments are needed to determine the results of the cross-mating.—[W. P. Shannon, Indiana, November 25, 1892.

NOTE.—As we have not received specimens of any of the species treated by our correspondent, we are unable to identify the species to conform to modern nomenclature with absolute certainty. But from our knowledge of the habits of these insects we may be reasonably certain that by *Lytta cinerea* and *marginata* are meant our two common color variations of *Epicauta cinerea; Lytta vittata* is *Epicauta vittata*, and *Lytta murina* is *Epicauta pennsylvanica*. We have had a precisely similar experience on the different species of Clematis (including all those mentioned) and found that no remedy other than shaking down and killing availed on account of the continued in-coming of specimens from other regions.—[EDS.

The Sweet-potato Root-weevil.

For the last three or four years we can not raise any more sweet potatoes fit for market on account of worms. I send a specimen of sweet potato with some bugs. In my opinion the bugs produce the worms, as the vines are always full of those bugs and when there are no bugs there are no worms in the sweet potatoes. I would like to know the name of the bugs and have your opinion whether they could be kept off by some means.—[H. Meyer, Plaquemines County, La., December 22, 1892.

REPLY.—* * * The sections of sweet potato have been carefully examined, and have been found to contain the larvæ of the Sweet-potato Root-weevil, *Cylas formicarius*. The green bugs have no connection with the larvæ in the potatoes. They are known commonly throughout the South as the Green Soldier Bug, *Nezara viridula*. The Green Soldier Bug frequently damages vegetation by inserting its beak and sucking the sap, the cotton crop and the fruit of the Orange being the most marked examples of this injurious work. The insect which does the damage in your case, however, is the Sweet-potato Root-weevil, and up to the present time no remedy has been found except to burn all potatoes which are found to be infested. If this should be carefully and thoroughly done throughout a neighborhood, the pest could be greatly reduced. It is a sub-tropical insect, and was first recorded as occurring in this country in 1875, when it was found in Louisiana. Three years later it made its appearance in injurious numbers in Florida. Where it has been abundant in Florida it has been practically stamped out by following the measures just recommended.—[December 31, 1892.]

A Weevil in Mullein Seeds.

While collecting seeds, September 29, I got some mullein seed which I put into an envelope without cleaning it. I noticed then that about half of the ovaries

contained either small flesh-colored larvæ or small bugs. While cleaning the seed this morning I found eight of these insects, some still alive. I send them in a quill, and would like to know what they are and something of their habits.—[S. C. Stuntz, Wisconsin, December 12, 1892.

REPLY.— * * * The species is *Gymnetron tetrum* Fab., one of the true weevils of the family Curculionidæ. It has been previously recorded as having this habit of feeding in the seeds of the mullein plant.—[December 17, 1892.]

A new Enemy to Cypress Hedges in California.

A friend of mine from Contra Costa County has just sent me the accompanying insects, and a specimen of the work they are doing to the Cypress hedges in their neighborhood. They were first noticed a few months ago near Martinez, and they are gradually eating their way through the Alhambra Valley, leaving nothing but dead trees behind them. Around here all our hedges and windbreaks are Cypress, and I should be glad to know how to deal with the destroyer should he make his appearance in this section. —[John Dickie, California, February 8, 1893.

REPLY.—This is one of the bark-beetles of the family Scolytidæ, and is known scientifically as *Phlœosinus cristatus*. These insects are all very difficult to handle when they have gained economic importance. They normally breed in dead, dying, or diseased woody vegetation and only attack living healthy trees when they have increased so greatly as to overflow, as it were, from their normal food supply. Having once acquired the habit of feeding upon healthy trees and shrubs, however, they will continue it for some time. The question of remedies is a very difficult one. Such portions of the hedges as have been attacked should be immediately burned, as it will be impossible to save them. This burning, of itself, will reduce the numbers of the insects to such an extent that the damage for a short time at least will not compare with that which would result without the employment of this means. At the same time if dead or dying trees or woody plants exist in the neighborhood, these should also be destroyed by fire, particularly if upon examination they are found to be infested by this same insect. Thorough work of this character will result in the great lessening if not the entire cessation of the injury, and there is no easier or less expensive way in which this can be brought about. From the standpoint of the economic entomologist the case which you describe is one of considerable interest, and I should be glad to receive further details from you in case your friend can furnish them. I should like facts concerning the amount of damage which has already been done, how long the insects have been at work, and whether there are plenty of dead or dying trees or stumps in which they can breed. If, as you seem to anticipate, the insect should make its appearance in your section, heroic measures should be taken from the start. If your friend has correspondents in the Alhambra Valley it will pay him to urge them to destroy the dead trees which you state are so abundant. Left standing, such trees offer breeding places for the beetles and are constant menaces to the healthy hedges.—[February 17, 1893.]

Another vegetarian Mosquito.

I was very much interested in Mr. Longuemare's account of a vegetarian mosquito in volume IV of INSECT LIFE (p. 214). I have never seen a mosquito eating potato, but was somewhat diverted last summer at seeing one try his tooth (?) at biscuit. I was camping by Cole Slough, the artery connecting Kings and San Joaquin rivers, and the biscuit was broken and lying by my plate, or at least half of it was, while I was disposing of the rest. Mosquitoes were scarce. I think this must have been a pioneer prospecting before bringing her family. I thought at the time she was either a scientist or a fool; for she let me rest, which never one was guilty of before, and settled on the biscuit. I was preparing to make the best of my advantage and sweep her to mosquito limbo when I saw her settle her bill into the bread. This turn of

affairs interested me and I began to watch. She would run her bill in as deeply as possible and then draw it half way out and plunge it back in the characteristic way of mosquitoes when they are enjoying a sanguinary repast on an animal. She stayed about five minutes, but did not seem to fill up in the least, so I concluded she was having a dry time of it, and as I wanted the biscuit I tried to move her off, not wishing to kill her after her entertainment, but she did not seem inclined to go, and only did so by being forced.—[Alvah A. Eaton, California, February 2, 1893.

The Cluster Fly Household Pest.

I send a few flies as specimens of a pest that has proven to be very troublesome to us for nearly fifteen years past. If the weather is favorable—which must be warm and sultry—they usually come out about the first of September and continue until the weather gets quite cool. They seem to prefer to occupy the rooms on the north side of the house and those that are used but little. They gather in large bunches in the corners and all along the edge of the ceiling of the room. They can not be driven out as other flies, but must be killed outright to get rid of them, and when you mash them the odor is like that of honey. We have tried nearly everything that we heard of that was recommended to us, with no effect. It seems impossible to get rid of them or keep them out of the house, for they crawl in through the smallest places in the windows. The fumes of sulphur or pyrethrum seem to have no effect upon them.

We would be glad to know something of the life-history and breeding places, and if there is any way to get rid of them.—[Mrs. A. E. Brunk, Lasalle County, Ill., October 21, 1892.

Reply.— * * * The insect is the common Cluster Fly (*Pollenia rudis*) so-called from the habit which you describe of clustering in houses in the fall. The early stages of this insect do not appear to be known, although we have found the puparia in the roots of grass about three inches below the surface of the ground. You can destroy the flies after they have entered the house by putting fresh pyrethrum powder upon them by means of a little bellows. The smoke of burning pyrethrum does not seem to avail against them. Of the different pyrethrum powders upon the market you will probably find "California Buhach" to be the freshest and best.—[October 25, 1892.]

Chrysanthemums and the Drone-fly.

On the back of the bulletin containing the Sugar-cane Borer article, you will see a letter by Mrs. S. Heaven, part of which relates to the non-seeding of Chrysanthemums here. It seems that if Chrysanthemums, which flourish well in our mountains, could be got to seed, a profitable industry might be carried on, the seeds being of high market value. It at once occurred to me that our want of *Eristalis tenax* might explain the non-seeding, and the question has arisen, Shall we import that fly? But there is some literature of the *Eristalis-Chrysanthemum* matter which I have not seen, and I have not learned that the pollenization by Eristalis is proved by experiment. I should be very glad to have your opinion on the matter. Do you believe in the alleged usefulness of the fly?—[T. D. A. Cockerell, Jamaica.

Reply.—There has been some discussion in American journals in regard to the cross-fertilization of Chrysanthemums by *Eristalis tenax*. You will find an article by Dr. John Hamilton in *Entomologica Americana* for May, 1890 (pp. 81–83), and shorter notes on pp. 126 and 218 of the same volume. An article by John B. Smith is printed in *Garden and Forest*, July 2, 1890 (p. 326), and another by J. G. Jack in the same journal for September 10, 1890 (p. 446). No careful and accurate experiments seem to have been made in this country, although it is a matter which could easily be settled by a few simple experiments. Certain Chrysanthemum growers consider this fly responsible for the cross-fertilization and consequent fertility and

good condition of their plants, while others destroy them on account of the fact that they injure the appearance of the flowers by ejecting a dark fluid upon the petals. There is no question that this insect is frequently found in greenhouses towards the end of the season, and as it works around in the flowers it undoubtedly bears the pollen from one to another and does some good work. Whether it is responsible for the seeding of this plant to the extent which has been claimed is very doubtful. It is certainly by no means exclusively confined to these flowers.

The Orange Fruit-fly in Malta.

For some years past the orange groves of these islands have been infested with the *Ceratitis citriperda* MacL., the ravages of which have produced so much damage to the orange industry here that his excellency the governor has just appointed another commission (of which I am a member) to inquire into the causes and to suggest remedies for the evil.

Of late years, too, it has been noticed that the number of insectivorous birds, indigenous and migratory, has greatly decreased. Do you think that this fact is in any way accountable for the unusual abundance of the orange-fly? Could you oblige me with any information as to whether insectivorous birds, the ordinary species, have any preference for the fly or its larvæ?—[John H. Cooke, Malta, January 1, 1893.

REPLY.— * * * As you know, *Ceratitis citriperda* does not occur in this country, although an allied species affects oranges across our border in Mexico and an insect which we have identified as *Ceratitis capitata* Wied. (of which *C. citriperda* MacL. is a synonym) injures peaches in Bermuda. The fruit-infesting species of the dipterous family Trypetidæ are in fact rather scarce in the United States, and but one species has attained any great economic importance, viz. *Trypeta* (*Rhagoletia*) *pomonella* Walsh, the larva of which is known as the "Apple Maggot" in our northwestern States. I think it altogether likely that the increase of the Ceratitis in Malta is to some degree consequent upon the reduction of the numbers of insectivorous birds, although there are no observations on record in this country with reference to the Apple Maggot which would support this conclusion, and I regret, therefore, that I can give you no information in direct answer to your question. I would call your attention, however, to an article upon *C. capitata* in volume III of INSECT LIFE (p. 5), and also to the excellent remarks on pages 469 to 477 of Dr. O. Penzig's "Studi Botanici sugli Agruni e sulle Piante affini," published by the Ministero di Agricoltura, Italy, 1887. Is not your insect *C. hispanica?*—[January 19, 1893.]

Plant-Bugs injuring Oranges in Florida.

I send a few Hemiptera for identification.

Nos. 1, 2, 4, and 5 were found at Altoona, Fla. They were captured while puncturing the rind of nearly ripe or ripe oranges while still on the tree. They evidently insert the tongue to the "pulp cells" and feed upon the orange juice. I have observed them for several minutes remain perfectly still with their tongues thus inserted. They are easily frightened, and it is difficult to find them in the act of inserting the tongue or to watch them long while feeding. I succeeded in cutting the heads off from several with the tongue remaining in, and microscopic sections of the rind containing the tongue thus cut off show the penetration to reach to the pulp. How much damage they do, if any, I can not say. No apparent damage has been observed. Mr. Cunningham, of Altoona, who first called my attention to them as insects affecting the Orange, reports them as "quite common."

No. 3, Hubbard has described as an orange insect, I believe, possibly the others also.—[H. J. Webber, Florida, December 7, 1892.

REPLY.— * * * The insects which you send are: 1. *Euschistus servus* Say. 2. *Nezara viridula*. 3. *Leptoglossus phyllopus*. 4. *Euschistus servus* (immature). 5.

Ranassa calva. You are right in supposing that Hubbard has already reported No. 3 as an orange insect, and the species which he figures upon page 160 is in all probability the same as your Nos. 2 and 4. It damages the orange crop occasionally, and also injures cotton bolls. No. 1 is not exclusively a plant-feeder, as it has been frequently found preying upon Lepidopterous larvæ, and is mentioned in the Fourth Report of the U, S. Entomological Commission as an enemy to the Cotton Worm.—[December 17, 1892.]

Fowls killed by Mole-crickets.

While residing in St. Vincent, one of the Windward Islands, I frequently heard of the destruction of domestic fowls by mole-crickets. The cricket is common about sugar plantations, where it burrows among the cane-roots, or conceals itself under stones and sticks. Where cane-patches adjoin plantation-houses, as is frequently the case, the fowls wander among them all day, no doubt delighting in the shade and concealment and finding plenty of insect food. They do not often discover the mole-crickets, because the latter keep well beneath the surface; but when they do find them, they swallow them eagerly. In doing so, they frequently bring about their own destruction; for the crickets finding the bird's crop uncongenial, at once proceed to burrow out; the insect escapes and the fowl dies.

One intelligent planter told me that he had given up fowl raising, because so many were lost in this way; others assured me of the truth of the story, and I have no reason to doubt it. I frequently requested these gentlemen to send me fowls which had been killed by the crickets, but was never able to obtain one. It would be interesting to know whether the insect burrows through the crop itself or through the sides of the gullet.—[Herbert H. Smith, New York, December 1892.

Roaches in Brazil.

Cockroaches are so common in Brazilian country-houses that nobody pays much attention to them. They have an unpleasant way of getting into provision-boxes, and they deface books, shoes, and sometimes clothing. Where wall paper is used they soon eat it off in unsightly patches, no doubt seeking the paste beneath. But at Corumba, on the upper Paraguay, I came across the cockroach in a new rôle. In the house where we staying there were nearly a dozen children, and every one of them had their eyelashes more or less eaten off by cockroaches—a large brown species, one of the commonest kind throughout Brazil. The eyelashes were bitten off irregularly, in some places quite close to the lid. Like most Brazilians, these children had very long, black eyelashes, and their appearance thus defaced was odd enough. The trouble was confined to children, I suppose, because they are heavy sleepers and do not disturb the insects at work. My wife and I sometimes brushed cockroaches from our faces at night, but thought nothing more of the matter. The roaches also bite off bits of the toe-nails. Brazilians very properly encourage the large house-spiders because they tend to rid the house of other insect pests.—[Herbert H. Smith, New York, December, 1892.

Screw Worms and the man-infesting Bot in Brazil.

I was once called npon to attend a little Brazilian boy, whose nose, with the sinuses and apparently the upper part of the pharynx, were literally alive with large maggots. He could only breathe through the mouth and was in great pain. The maggots were introduced by a blow-fly (probably one of the common green flesh-flies) through the nostrils, while the boy was asleep.

Luckily, I had a piece of rubber tubing, with which I arranged a nasal douche; dilute carbolic acid was repeatedly passed through the nose, the maggots dropping out in great masses; in the end all were removed, and the boy speedily recovered.

I was told that he had had a previous experience of the same kind, but less severe, and on that occasion he got rid of the pests without any treatment. Cases of this kind are quite frequent in South America, and they are decidedly dangerous. I heard of several well-authenticated instances where death resulted, the maggots either working their way out into the brain or eating out through the sides of the cheek. An American physician, practising in Brazil, told me that an injection or rather spray of chloroform was the most effectual cure, though he indorsed my own treatment in the case mentioned above. Slight wounds on animals in the tropics are likely to result disastrously if they are exposed to the attacks of blow-flies. The common preventive and remedy is corrosive sublimate, but I have found carbolic acid better and less painful.

While on the subject of maggots I may mention the Œstrid, which frequently attacks man in the American tropics. I believe the life history of this insect, if, indeed, there be only one species, has never been traced. The maggots are first apparent by a little sore resembling a small boil, on any part of the body; if neglected, the sore enlarges somewhat, but without any extended inflammation; the worst result is generally an intolerable itching. A common and barbarous remedy is to squeeze the maggots out through the small air-opening on the surface. This is difficult and very painful, as I can attest from personal experience. A better way is to put a drop of strong carbolic acid on the sore and then leave it until the next day when the maggot can be easily squeezed out. Still better is the remedy discovered by the Brazilian country people. They tie a bit of fresh pork-fat tightly around the wound; the maggot is thus deprived of air, and in the effort to obtain it, emerges from the skin, burrowing into the pork.—[Herbert H. Smith, New York, December, 1892.

NOTE.—The "Blow-fly" was probably *Lucilia macellaria*, our common "Screw-worm Fly," or some allied species, while the Bot-fly was probably *Dermatobia noxialis*, which has been frequently referred to in the pages of INSECT LIFE.—[EDS.

The Chipping Sparrow and House Wren as Insect Destroyers.

I have seen the Chipping Sparrow hopping from one cabbage plant to another in my garden and deftly picking out of them the green larvæ of the Imported Cabbage Butterfly. I believe this common bird to be a great aid in keeping that great pest to gardeners in check.

I have also observed the House Wren very skillfully removing tent caterpillars from their webs. This little bird is remarkably industrious in the extermination of noxious insects.—[J. M. Keck, Ohio, December 12, 1892.

The Clover Mite in Houses again.

I have been troubled the past three years with insects. They crawl on the inside of the windows and wall no matter how cold the day is in winter or how hot in summer; if the sun shines they are crawling about. I have collected a few to send you, and for fear anything should happen to them I will describe them. The young are small, barely visible with the naked eye and are fire red. When fully grown their body is brown, legs red, and are big as quarter the size of head of a pin. Some I killed leave a green stain, some yellow. Their haunts seem to be in the plaster or rough stone foundation to the house, or where there are rough boards. They are worse in a dry season. I have tried hot water and freezing them, alum, camphor, borax, insect powder, red pepper, turpentine and kerosene, but do not seem to get rid of them, so I write to see if you can give information that will exterminate them. —[Mrs. Eva Bashaw, Minnesota, December 21, 1892.

REPLY.—* * * The creature which you find in your house so abundantly is the common Clover Mite (*Bryobia pratensis*) a full account of which is given in INSECT LIFE, vol. III, pp. 45-52. * * *—[December 27, 1892.]

A new Chicken Plague in Texas.

A new chicken plague appeared last summer and to some extent continues through the winter. It is caused by an animal, specimens of which I send in alcohol. This creature attacks the hens, sucks itself full of blood, falls off, retires into the walls of the chicken house, and comes for a new supply when it feels hungry. Pullets it kills by creeping in masses under their wings, under their shoulders, and actually sucks their lives out until they die. In this section of the country this animal is a new-comer, but is already known in a larger portion of this county, and I was requested to send specimens to your Department for inspection, comparison, and possible remedy. Soapsuds with carbolic acid have been tried but gave no satisfaction. I shall try in a few days a thorough smoking with burning sulphur, and if successful will report to you.—[Albert Turpe, Kinney County, Tex., February 14, 1893.

REPLY.—The creatures which are damaging chickens in your vicinity belong to a rather rare species in this country known as *Argas americana*. They belong to the family of Ticks, so-called, and their nearest allies are the mites and spiders. The common Cattle Tick of Texas, *Ixodes* or *Boöphilus boris*, is not distantly related. Inasmuch as a rather strong kerosene soap emulsion has proved to be efficacious against the Cattle Tick, there is every reason to believe that it would be equally effective against this chicken parasite. You are therefore advised to make a strong emulsion according to the formula given upon page 3 of circular No. 1 of this Division, and to wash the infested poultry and spray the mixture thoroughly about the hen-coops and poultry yards. It is quite likely that the addition of a small quantity of flowers of sulphur to this mixture will render it more effective, but such an ingredient is not a necessity. You may reasonably expect relief by a careful and thorough use of this substance.

The Entomologist would be very glad to receive any further facts which may come to your notice respecting the spread of this insect, the time of its appearance, and the amount of damage which it seems to be doing.—[February 21, 1893.]

NOTES FROM CORRESPONDENTS.

The Cattle Tick affecting Horses.—The common cattle tick of the southwest (*Boöphilus boris*) has not been recorded as affecting horses in this country. It is therefore worthy of mention that one of our correspondents, Sir Alfred Moloney, Governor of British Honduras, has recently sent us specimens of this creature which were taken from a horse in that Central American colony.

The smallest Insect known to Entomologists.—We have recently received a communication from one of our correspondents asking the name, size, and locality of the smallest insect known to entomologists, and replied that so far as known the smallest true insect which has ever been described is *Alaptus excisus* Westw., a minute parasitic Hymenopteron which occurs in England. Its length is seventeen hundredths of a millimeter, or from six to seven thousandths of an inch, and it is of slender form. This little species is probably parasitic in the eggs of some bark-louse. It is quite likely that there exist other species still smaller, but if so, they have escaped the eye of the entomologist up to the present time.

The Rose Icerya on Lignum Vitæ.—Mr. T. D. A. Cockerell, of Kingston, Jamaica, reports that *Icerya rosæ* R. and H., is found abundantly at Kingston, Jamaica, under the bark of *Lignum vitæ*. He thinks it highly probable that this Coccid is a native of Jamaica, and that *Lignum vitæ* is a natural food-plant, from which it has spread to cultivated roses.

A naturalized Panchlora.—Our extract from correspondence in the last number, entitled "A Tropical Cockroach in a New Orleans Greenhouse," has fallen under the critical eye of Mr. S. H. Scudder, of Cambridge, Mass., who is kind enough to inform us that, in his opinion, *Panchlora surinamensis* may be stated to be naturalized in this country. He bases his very just opinion upon the fact that Mrs. Annie Trumbull Slosson has taken mature and immature specimens in different years at Puerta Gorda, in the extreme south of Florida, a barren spot, with but little vegetation and this mostly tropical.

Eucalyptus vs. Mosquito.—Apropos of mosquito remedies, Mr. Alvah A. Eaton, whose letter on the bread-eating mosquito we publish on another page, writes that in California and other places where the Blue Gum grows no other remedy need be sought for. No matter how plentiful the mosquitoes, a few twigs or leaves, so he writes, laid on the pillow at night will secure perfect immunity. This is that same *Eucalyptus globulus* which is now being extolled as a panacea for all ills and insects. We should be glad to learn more of its value as an insect repellent.

Damage by Locusts in Pennsylvania.—A correspondent in McKean County, Pa., states that during the summer locusts of at least half a dozen species literally covered the face of the earth. The damage to cut hay amounted to one-third of the crop. In parts of Clinton County much damage was done and dryer weather was never known. No rain to amount to anything fell from the first week in July to the 1st of December.

A serious Case of Bee Sting.—A correspondent writes that a child three years of age was stung about one hundred times in various parts of her body in September, 1892. She was very ill, suffering from severe pains, followed by faintness, vomiting, and stupor. No physician was employed and the only treatment consisted in bathing in spirits of camphor. The child was ill for some weeks and wherever stung a small pustule formed which was slow to heal. At the expiration of three months the child was still feeble.

The edible Qualities of Ants.—It has long been known that the formic acid present in ants in such quantity is normally of such strength that it is not disagreeable to the palate. As a boy Mr. Howard tried the experiment of crushing ants with sugar and water as a substitute for lemonade and recollects that it was drunk with relish by his companions. A correspondent writes us recently that one of her hired men is in the habit of eating large black ants found in rotten wood. She also states that her father, after eating a large section of railroad restaurant pie in the dark, and noticing an agreeable acid flavor found that the remainder was swarming with specimens of the little Red Ant (*Monomorium pharaonis*) and that he must have eaten some hundreds of individuals. He was satisfied with his experience, which he did not repeat voluntarily, but he vouches for the edibility of this species. What the original ingredients of the pie were is not stated, but the effect of the combination was to make it about as sour as rhubarb.

A new popular Name for the Blood-sucking Cone-nose.—Mr. J. B. Lembert, a California correspondent, writes us concerning an insect which, from his description, we take to be *Conorhinus sanguisuga*, and which he states is known in his vicinity as the "Monitor Bug." He says that it is found in beds, and that its bite is severe.

An Omission.—The Secretary of the Association of Economic Entomologists, Mr. F. M. Webster, writes us that in the list of members which he furnished for publication in INSECT LIFE, vol. V, page 131, the name of Mr. A. D. Hopkins, Entomologist Agricultural Experiment Station, Morgantown, W. Va., was inadvertently omitted.

Additional Damage by Walking-sticks.—Mr. T. D. A. Cockerell, of Kingston, Jamaica, apropos to our note on page 63 of No. 2, on reported damage by Phasmids, writes us that *Necrossia cyllarus* Westw. did considerable damage to a hedge (kind not mentioned) in Jamaica in 1891.

An Insect Enemy of Chocolate.—Dr. C. C. Beach, of Hartford, Conn., has sent us the larva of *Sitodrepa panicea* found living in commercial chocolate. They were

first noticed by a Hartford druggist who, upon applying to the wholesale dealer from whom he bought the chocolate, was told that the little white bits were not really alive but were only small lumps of chocolate.

Sitodrepa panicea again.—Shortly after receiving this insect in chocolate Judge Lawrence C. Johnson sent us from Pachuta, Miss., specimens of the old-fashioned shot-gun wads which had been riddled by this same insect. About a dozen wads were received, each one perforated from top to bottom by many holes, while between the upper and lower surface the substance of the wad was reduced to powder.

Dipterous Larvæ infesting a Turtle.—An Indiana correspondent, Mr. Wm. A. Riley, has lately sent specimens of a larva closely related to the Screw Worm (*Lucilia macellaria*) which was found beneath the skin of a turtle, between the hind legs. It is evidently a species of the genus Lucilia, and doubtless identical with the larva mentioned by Mr. F. W. True in *Science* (vol. IV, p. 511), also taken beneath the skin of a turtle. A somewhat similar instance is mentioned by Dr. A. S. Packard in the *American Naturalist* (vol. XVI, p. 598).

Injurious Snails in Bermuda.—One of our correspondents, a seed dealer of Philadelphia, sends us specimens of a snail, *Bulimus decollatus*, known as the Broken-tail Snail, with the statement that they were received from Bermuda, where they had recently appeared in great numbers on Amaryllis beds. Although these creatures are rather outside the province of entomology, we have been considerably interested in the accounts of the damage which they do in several of the West India islands, particularly in Bermuda, and we would suggest to such of our correspondents as are suffering from the inroads of these pests to apply for an interesting little pamphlet recently published by the Queen's Printer in Bermuda, Mr. G. V. Lee, under the auspices of the Board of Agriculture, entitled "Five Essays, etc., History of the Spiral Snails and the most expeditious, efficacious, and economical method of effecting their extermination."

On the Habits of three California Coleoptera.—Our agent, Mr. Coquillett, has sent us, under date of March 6, some interesting notes on three species of California Coleoptera. *Odontota californica* was bred in September from larvæ mining the leaves of *Ceanothus integerrimus* collected August 22. We have also received specimens of a Chalcidid bred from these larvæ. *Copturus lunatus* was found in its burrows in the main stems of growing plants of a species of Cnicus, September 28, and these burrows also contained larvæ, evidently of this species. *Copturus adspersus* was taken from dead and dry stems of a weed, probably *Chrysopsis villosa*, January 20.

GENERAL NOTES.

AN ENEMY OF THE SCREW WORM FLY.

We are indebted to Dr. C. Hart Merriam, Chief of the Division of Ornithology and Mammalogy, for a vial containing a large number of the puparia of the well known Screw Worm (*Lucilia macellaria*) which had been sent to him by Mr. H. P. Attwater, of Rockport, Tex., with the memorandum that they were being scratched out of the ground and eaten by the Caracara Eagle (*Polyborus cheriway*). This eagle is a common subtropical carrion bird in that part of the country, which also feeds upon small mammals and lizards, and is abundant enough, in case this habit should be at all common, to do considerable good.

THE ARCHIPPUS BUTTERFLY EATEN BY MICE.

Dr. Merriam has also given us a box containing a number of wings of the common Archippus butterfly (*Danais archippus* = *Anosia plexippus*) which were sent to him by Mr. Attwater, above mentioned, with the following label: "Wings of butterflies, the bodies of which have been eaten by white-footed mice, from an island in Aransas Bay, four miles south of Rockport, Tex., collected November, 1892." This observation bears an especial significance. The Archippus butterfly is a migratory species, as has been frequently stated in these pages, and flies south on the approach of winter for hibernating purposes. It is, moreover, one of the species which is seldom or never attacked by birds on account of its nauseous taste and odor. Abundant evidence in support of this fact we brought out in an article on mimicry as illustrated by *Limenitis disippus* and *Danais archippus* in our Third Report on the Insects of Missouri. The former species bears a strong protective resemblance to the latter. Mr. Attwater's observation shows that, however exempt the Archippus may be from birds and other natural enemies, it is unquestionably destroyed by these little white-footed mice in considerable numbers when hidden away in hibernating quarters in the south. The box which he sent contained 43 hind wings and 50 front wings, and of the front wings there were 23 right and 27 left, representing the destruction of at least 27 specimens. The mouse referred to in the field note, Dr. Merriam informs us, is not a white-footed mouse, but one of the grasshopper or scorpion mice of the genus Onychomys.

NOTES ON SOME INSECT PESTS OF THE FIJI ISLANDS.

Our agent, Mr. A. Koebele, has lately sent us a small lot of specimens with accompanying notes of interest. The Sandwich Island Sugar-cane Borer, which was treated in volume I of INSECT LIFE (pp. 185–189) he states is also very destructive to cane in the Fiji Islands. A somewhat similar Calandrid was associated with this species under the same number and has doubtless the same or similar habits. Neither of these, it should be said, belong to the true genus Sphenophorus as at present restricted. A third species is also sent with the statement that it is destructive in the larva state to cane by feeding on the larger roots. It is a Scarabæid, bearing some resemblance to our Lachnosterna, and probably belongs to the genus Anchylonycha.

Mr. Koebele also sends a Tineid Moth, belonging, evidently, to the Plutellidæ, and found feeding in the stalks of the Sugar-cane, and a small, black Pyromorphid closely related to our Acoloithus and Harrisina. The latter is said to be spreading over the South Sea Islands where it is destroying the palm leaves by devouring the epidermis. He further says, writing under date of February 13, that all the cocoanut plantations in the Fijis are being ravaged, the trees bearing only a few green leaves at their tops. He has been informed that the insect first appeared some years ago at the Sandwich Islands, coming, it is

believed, from South America. If relief is not soon found it is probable that one of the most thriving industries of these islands will have to be abandoned.

ENTOMOLOGY AT THE IOWA STATE UNIVERSITY.

Volume II, No. 3, Bulletin from the Laboratories of Natural History of the State University of Iowa, published January, 1893, contains three entomological articles by Mr. H. F. Wickham. The first of these includes an account of the earlier stages of three North American Coleoptera, viz, *Dicælus splendidus*, *Epipocus cinctus*, and *Ellychnia californica*. The second is a report on an entomological reconnoissance of southern Alaska and adjacent portions of British Columbia, which contains an interesting account of his methods of collecting and an itinerary of the journey, concluding with a list of the species captured; the list is a rather long one, covering twenty pages of the Bulletin. The third article is a short one announcing the westward spread of the European *Aphodius fossor* to Iowa City and the finding for the first time in this country of the European *Rhinoncus inconspectus*. The first article is illustrated by a plate giving structural details of the larva and pupa of each of the three species of Coleoptera. The figure of *Epipocus cinctus* corresponds fairly well with drawings which we had made of *E. punctatus* some six years ago from specimens which we mentioned in the Proceedings of the Entomological Society of Washington, volume I, p. 37.

LOCAL NAMES FOR COMMON INSECTS.

Several times in the columns of this journal we have solicited correspondence with regard to local names for our commoner insects, and a number of our correspondents have responded.

The most interesting information on this head has lately come to us from Mr. Alvah A. Eaton, who sends quite a list of names current between Newburyport, Mass., and Portsmouth, N. H. Some of them are entirely new, and are probably quite local. The Walking Stick (Diapheromera) is there known as "scorpion." The term "huckleberry bug" is used indiscriminately for a species of red mite and for soldier bugs, just as "red bug" is applied in the South to mites and the Cotton Stainer. May Beetles and the like are called Dor Bugs, an old English name for this class of Scarabæids. "Crackamire" and "Needle Ichneumon" are the names given the long, slender Ichneumon flies. The large Locustidæ, or long-horn grasshoppers, are very appropriately called "cradlers" from the resemblance of the ovipositor of the female to a grain cradle, but most singular of all is the application of the name of locust to the large Bombycid moths, such as the Cecropia, Luna, and Polyphemus, and of lady-bird for the Sesiid or Humming-bird Moths.

A New York correspondent writes us that the carpet beetle, *Anthrenus scrophulariæ*, universally but incorrectly called "Buffalo moth," is known in certain towns along the Hudson as "Russian moths."

The different names that have been proposed for the *Acanthia lectularia*, the insect which "has no wings at all," but which makes its presence felt notwithstanding, will fill several pages. Around Boston these torments are called "chintzes" and "chinches," and from Baltimore we get the name "mahogany flats," but in New York they speak of them as "red-coats."

LEGISLATION AGAINST SPRAYING.

We notice an item in Garden and Forest for December 7, 1892, to the effect that the Ontario legislature passed an act at its last session forbidding the spraying or sprinkling of fruit trees while they are in bloom with any mixture containing Paris green or other substance poisonous or injurious to bees. This question has already received attention in the pages of this journal, and at the last meeting of the Association of Economic Entomologists a paper was read by Mr. F. M. Webster, which, taken together with the discussion, failed to prove that bees are injured by such spraying. Moreover, the legislation was hardly necessary, for the reason that at present it is not considered desirable to spray the fruit trees while in bloom in order to destroy any of our injurious insects.

AN EXHIBITION OF SPRAYING MACHINES.

An important exhibition of spraying machines for the application of Bordeaux mixture was held at Wevelghem, Belgium, the 21st of July, 1892. Numerous exhibitors from Germany, Switzerland, and Belgium took part, France being represented by Messrs. Besnard, Duru, Japy, Loumaigne, Vermorel, etc. The first prize, a medal of the ministry, was awarded to the "Eclair" of M. Vermorel. The second and third prizes went to Belgian exhibitors.

ECONOMIC ENTOMOLOGY AT THE CAPE OF GOOD HOPE.

We have frequently quoted in these pages from the Agricultural Journal, published by the Department of Agriculture of the Cape Colony, and it may be inferred from the frequency of our notes that the farmers of South Africa are wide-awake to their own interests in fighting injurious insects. Prof. P. MacOwan, although not a trained entomologist, as he informs us in a recent letter, has been doing excellent work in the way of giving advice to the farmers in the columns of the Journal, and each number which has reached us of late has been of increasing interest. The issue for December 29, 1892, contains among other matter notes concerning the hatching of locusts in one of the Provinces; a lengthy review of the work done in North Africa by the French against migratory locusts; a letter upon the Orange Fruit-worm (*Ceratitis citriperda*) and upon the Grape Phylloxera, which we wrote at Prof. MacOwan's request; an editorial on the subject of protecting corn from weevils, in which a specially constructed air-tight building is advised; a letter on the value of hemp for preserving grain,

and an article on spraying for insect pests on fruit trees, by Mr. P. Rodbard Malleson.

PARASITES OF ANIMALS TRANSMISSIBLE TO MAN.

Prof. A. Railliet of Paris has just sent us an interesting pamphlet of some 50 pages devoted to a consideration of the parasites transmissible from animals to man, which is, for the most part, occupied with the treatment of intestinal parasites, but which also takes up certain insects. The latter comprise principally external parasites, and of these largely those which are free or temporary. The species principally mentioned under this category are the Stable Fly (*Stomoxys calcitrans*), the African Tsétsé Fly (*Glossina morsitans*), the common Horse Fly (*Hippobosca equina*), and species of Simulium and Pulex. These are all of importance on account of the fact that they may become transmitters of contagious diseases. Among the Arachnida, he mentions the species of Dermanyssus and Argas. Some attention is also paid to Ochromyia, Sarcophaga, Hypoderma, and Dermatobia, all of which occasionally infest human beings, while the Chigo of Tropical America (*Sarcopsylla penetrans*), the Dog Tick (*Ixodes ricinus*), the larval Trombidium and several species of the family Sarcoptidæ are also treated briefly.

FURTHER ILLUSTRATIONS OF THE ROSE SLUGS.

It was our intention in the article in the September number of INSECT LIFE on Rose Saw-flies in the United States to have presented figures of the commoner species *Monostegia rosæ*, which we had made some years ago. These illustrations are given herewith. Fig. 35 represents

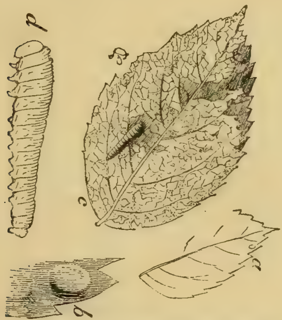


FIG. 35.—*Monostegia rosæ*: *a*, egg *in situ*, natural size; *b*, do., enlarged; *c*, skeletonized leaf with larva feeding, natural size; *d*, larva enlarged (after Riley).

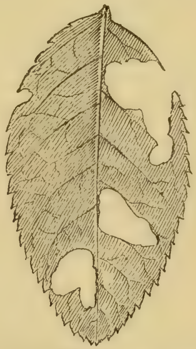


FIG. 36.—*Monostegia rosæ*: work of full-grown larva in rose leaf, natural size (original).

the early stages; the egg, natural size, is shown *in situ* at *a*, and considerably enlarged at *b*. The appearance of the larva on the leaf and

the characteristic skeletonizing of the leaf are shown at *c*, while a magnified lateral view of the larva is given at *d*. Fig. 36 represents a leaf eaten by a full-grown larva, in which none of the skeletonizing of the early larval stages is present. Fig. 37 is an enlarged view of the female fly, the natural size being indicated by the hair lines beneath. The ovipositor, by means of which the slit in the leaf for the insertion of the eggs is made, is shown at *b*, and the antenna at *c*. The first and last of these figures are reproduced from our account of this insect in the *American Entomologist*, vol. III (new series, vol. I) page 115.

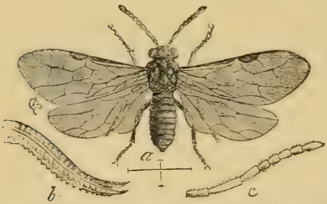


FIG. 37.—*Monostegia rosæ*: *a*, female; *b*, ovipositor of female; *c*, antenna of female, all enlarged (original).

COCKROACH EGG PARASITES.

The commonest parasite of the cockroach egg capsule in Europe is the old Linnæan *Evania appendigaster*. This insect has been described in different parts of the world under a great many different names, and although an indigene in Europe, was found in Cuba as long ago as 1829. It has also been found in the United States by Dr. Packard, Mr. Ashmead, and others. The good which might be accomplished by this important parasite is modified by the fact that it has a destructive secondary parasite, which was described by Ratzeburg in 1852 as *Entedon hagenowi*. We should indeed be fortunate in this country if the Evania had been imported without its own particular enemy, but in a collection of micro-hymenoptera from the academy of Natural Sciences in Philadelphia, which has been loaned to this Division for study, Mr. Ashmead has found specimens of this *Entedon hagenowi* in a lot of Cuban micro-hymenoptera sent to Mr. Cresson many years ago by Dr. Juan Gundlach and Prof. Felipe Poëy. The larger species of this particular sending were described by Mr. Cresson in his paper on the Hymenoptera of Cuba in the Proceedings of the Entomological Society of Philadelphia for 1865. Mr. Ashmead also informs us that in his old Florida collection he has specimens of the secondary parasite collected in that State.

THE HYMENOPTERA OF AUSTRALIA.

Some two years ago Mr. W. W. Froggatt, of the Sydney Museum, published Part I of his "Catalogue of the Described Hymenoptera of Australia," carrying the list through the remarkable family Thynnidæ, a group in which the Australian fauna is wonderfully rich, not less than five hundred species having been listed.

We have recently received from him Part II of the Catalogue, which is a reprint from the Proceedings of the Linnæan Society of New South

Wales, Second Series, volume VII. In this part the author lists the Scoliidæ, Sphegidæ, Pompilidæ (wrongly spelled with a double i), Larridæ, Nyssonidæ, Philanthidæ, Crabronidæ, Bembicidæ, Masaridæ, Eumenidæ, Vespidæ, Andrenidæ, and Apidæ.

The Catalogue is wisely published in small octavo, with blank leaves freely interspersed. The latter feature is one which will be appreciated by collectors.

THE GENUS MIRAX.

Mr. William H. Ashmead, in Psyche for January, 1893, describes five species of the genus Mirax, which is the first time this genus has been recorded in this country with the exception of the indication of three species by manuscript names in INSECT LIFE, vol. III, p. 15. The genus belongs to the Microgasterinæ, and all of the species so far known are parasitic upon micro-lepidoptera. But one species is known in Europe.

AN IMPORTANT PAPER ON BUTTERFLIES.

Under the title "The Tropical Faunal Element of our Southern Nymphalinæ systematically Treated," Mr. S. H. Scudder has published in the current volume of the Proceedings of the American Academy of Arts and Sciences (pp. 236–251) a paper of great interest to the student of faunal limits. He shows that nearly all the genera of the subfamily Nymphalinæ, which are essentially tropical or sub-tropical and are represented on the extreme southern border of the United States by a very few species each (and some of these must be considered more or less accidental visitors), belong to a few tribes which directly follow one another between the Nymphalini and the Vanessini. In previous systematic arrangements they have not been as closely connected as they should be, on account of the great diversity of forms, and Mr. Scudder therefore gives a succinct treatment, with accounts of the early stages, largely drawn from Wilhelm Mueller's "Südamerikanische Nymphaliden Raupen," but supplemented from various sources.

THE TOBACCO SPHINX IN LOUISIANA.

Bulletin No. 20 of the Second Series, North Louisiana Experiment Station, just received, is devoted to the subject of tobacco-growing in Louisiana, with results of experiments at Calhoun. In a paragraph towards the end of the bulletin brief mention is made of the damage done by the larva of the Tobacco Sphinx, and the statement is made that the old remedy of injecting a few drops of sweetened cobalt into the tubular-shaped flower of the common "jimpson weed" has proved quite effectual in Louisiana. The jimpson weeds were transplanted to the margins of the tobacco fields for use in this way, and it is interesting to note that the farmers of Louisiana are so imbued with the desirability of clean culture that visitors to the station have been in the

habit of pulling up these jimpson weeds so extensively that the Director has published a warning.

CANKER-WORMS IN CALIFORNIA.

On page 167, vol. IV, in reviewing a paper by Mr. Alexander Craw, we mentioned his identification of the Fall Canker-worm (*Anisopteryx pometaria*), from the larva alone, as open to doubt. The present season, however, Mr. Coquillett has reared the adult insects, and from good material which he has sent us we are able to decide that Mr. Craw's surmise was correct and that the species is identical with the eastern *A. pometaria*.

THE MEDITERRANEAN FLOUR MOTH IN CALIFORNIA.

We mentioned in the November number of INSECT LIFE the appearance of *Ephestia kühniella* in flour mills on the Pacific Coast. The *American Miller* of January 1, 1893, has a long article under the title "Flour Moths in California," in which it reviews the articles published by this journal, by Mr. James Fletcher, the Entomologist of the Central Experiment Farms, Ottawa, Canada, and by Miss E. A. Ormerod, of England, and states that the San Francisco *Call* has been investigating the occurrences of the insect in California. The result of this investigation shows that the Ephestia has already become an alarming pest, and that its work has resulted in the loss of thousands of dollars to a number of large establishments. The Pacific Coast occurrences have been carefully studied by Mr. W. G. Johnson, instructor in entomology at Leland Stanford, Jr., University, who is reported as stating that the disastrous effects of the insect's work will undoubtedly be very apparent in nearly all of the mills of the State before the end of another year.

We may mention in passing that M. J. Danysz has recently started a private "Laboratoire de Parasitologie" in Paris, and has studied the occurrences of this insect in France, and that after thoroughly considering all of the facts he is inclined to agree with our original supposition that the insect is not American in its origin, as has been claimed by European writers heretofore. M. Danyzs, by the way, places less reliance on the use of kerosene emulsion or bisulphide of carbon as a remedy against this insect than upon a strong tobacco wash.

TENT CATERPILLARS IN MASSACHUSETTS.

The Massachusetts horticulturists, taking advantage of the liberal disposition of the State Legislature with regard to appropriations for fighting the Gypsy Moth, propose to memorialize this body for further appropriations to be used against the Tent Caterpillar which has become a great pest in certain of the New England States. At a meeting held in December a committee of the State Horticultural Society was

appointed to bring the matter before the legislators. It will be remembered that in an early number of INSECT LIFE we drew attention to the novel means in use in Connecticut for destroying similar tents which consisted in blowing them to "kingdom come" from a shotgun.

RESULTS OF CODLING MOTH LEGISLATION IN TASMANIA.

In the *New Zealand Farmer* for July, 1892, we find a long and interesting article under this caption, showing that the chief inspector of the Hobart Fruit Growers reports that there has been a decided diminution of the Codling Moth in Tasmania as the result of the work of the Board. The methods in use have been to destroy infested fruit and to spray with Paris green at the rate of one ounce to 20 gallons of water.

A VINE PEST IN AUSTRALIA.

Some of the South Australian newspapers have been publishing alarming items about a new insect which is attacking the vines in different parts of that Colony. It is particularly abundant at a place called Orroroo. Our correspondent, Mr. Walter C. Hackett, determines this insect as the larva of *Chœrocampa celerio* and states that on account of its large size and conspicuous appearance it can always be kept in check by handpicking.

THE SUGAR-CANE PIN-BORER AGAIN.

The *Agricultural Record*, the official journal of the Central Agricultural Board of Trinidad, for November, 1892, contains on pages 151 to 156 certain correspondence upon sugar-cane borers, which is of great interest and importance. A letter from Mr. J. G. Coull, of St. Vincent, addressed to the Royal Kew Gardens, September 7, 1892, transmits specimens of canes the top portions of which have been injured by the Larger Sugar-cane Borer (*Diatræa saccharalis*) while the lower portions were infested by *Xyleborus perforans* and Mr. Coull claims that the observations of the season have set at rest the controversy as to whether the Xyleborus is the original cause of the damage to the canes, stating that it has been satisfactorily proved that Mr. G. W. Smith, of Grenada, and Mr. H. H. Smith, of Brooklyn, are correct and that the cane is primarily attacked by the "Moth Borer" and that when its health has been injured and acidity sets in, then the Xyleborus takes possession. He states that the main attacks of the moth-borer are at intervals of fifty to sixty days and that the proper time to destroy them is when they attack the young sprouts in May, June, or July. At this time all plants showing signs of disease should be cut out. Careful inspection in August and September and again in November and December and the burning of affected cane-pieces are recommended. Mr. Coull's letter and specimens were referred to Mr. W. H. F. Blandford whose report is appended. Mr. Blandford found the burrows of the Diatræa and of the Sphenophorus mentioned in INSECT LIFE by Mr. Cockerell, and

noticed that the burrows of the larger borers were all towards the summit of the cane, invariably destroying the terminal joints. The burrows of the Xyleborus on the contrary were in the lowest part of the stem and were recent compared with the tracks of the larger borers in the tops. The canes sent to the Kew Gardens, however, Mr. Blandford surmises, were selected for the purpose of exhibiting this state of affairs and he had no means of telling except from Mr. Coull's statement whether it was common. Mr. Coull, however, did not distinguish between the work of the Diatræa and the Sphenophorus, nor is it likely to be necessary except as regards periods.

Mr. Coull's observations coincide with what we have suspected to be the true state of affairs, although exceptionally healthy canes may be injured by the Xyleborus. The fact remains, however, that if the more normal nidus is destroyed in the cane fields the insects will either be reduced in numbers or will resort to other normal conditions away from the cane fields rather than take on a perfectly exceptional habit. It is interesting to note that the Xyleborus on arrival were found to have bored entensively into the soft deal boxes in which the sections of cane were sent.

THE MUSTARD BEETLE IN ENGLAND.

Our esteemed correspondent, Mr. Fred. Enock, has sent us a little paper published in the *Entomologist* for October, 1892, referring to the extraordinary abundance of *Phædon cochleariæ*, commonly known as the Mustard Beetle, in England the present summer. This insect is known as one of the greatest crop pests in England and for fifty years has been increasing and it would be a most undesirable species to introduce into the United States. Both brown and white mustard have been ruined. In one field of white mustard in which the plants were from nine inches to a foot high, every plant was found to be absolutely swarming with beetles. Mr. Enock, with his customary attention to minutiæ, took the trouble to count the eggs on one plant. The top leaf held 85 eggs, the middle ones about 150 to over 500, while on the lower leaves were no less than 700. On reaching the thirty-fifth and last leaf he added up and found that one plant carried 9,234 eggs. It is needless to say that it was not long before the plants were completely skeletonized. The fields as a general thing were small and Mr. Enock suggests as a remedy the use of the sweeping or beating net. He himself collected the beetles by hundreds in this way and records the fact that a German saved his crop in this manner. It should be done, however, at the right time, when it will unquestionably pay.

NEW SPECIES AND GENERA OF RHYNCHOPHORA.*

Capt. Casey has recently published another paper of new species and genera of Coleoptera. It is entitled "Coleopterological Notices, IV,"

* Coleopterological Notices, IV. By Thomas L. Casey. Extract from Vol. VI, Annals New York Academy of Sciences, August, 1892.

and covers pages 359 to 712 of Vol. VI of the Annals of the New York Academy of Sciences, and with the exception of the last three pages, is devoted exclusively to two families of Rhynchophora.

The great tribe *Barini* is treated in monographic form, and in addition synopses are given of the following genera: Dorytomus, Smicronyx, Promecotarsus n. g., Tychius, Thysanocnemis, Otidocephalus, Acamptus, Tyloderma, Phyrdenus and Zygops of the Curculionidæ, and Cactophagus, Calandra, Yuccaborus, Himatium, Allomimus, Pseudopentarthrum and Pentarthrinus n. g., of the Calandridæ.

In Calandra, a genus which includes our Rice and Grain Weevils and others of the greatest economic importance, the author considers *remotepunctata* a synonym of *granaria*, and adds to our fauna *linearis* Hbst. and *rugicollis* n. sp. The occurrence of *linearis* in our southern states has been recognized for years past, but we should hesitate before including *rugicollis* in our faunal list, founded as the species is on a single Florida specimen, of probably accidental occurrence.

In the concluding chapter of the appendix the author suppresses twenty-two of his own species of Stenus, thus indicating a most praiseworthy disposition to change his views upon acquiring additional facts and material.

WESTWARD SPREAD OF THE CLOVER-LEAF WEEVIL.

We learn from an article by Mr. A. W. Butler, in the *Indiana Farmer* of January 14, that *Phytonomus punctatus* has been found the past season in northwestern Ohio in injurious numbers and also in the vicinity of Cincinnati. Anticipating its spread to southeastern Indiana the coming season Mr. Butler republishes our figures from the 1881–'82 report and gives a full account of the life history of the insect.

THE LARVAL HABITS OF THE ACALYPTRATE MUSCIDÆ.

Prof. C. H. Tyler Townsend, in the *Canadian Entomologist* for January, 1893, gives a most valuable summary of the known larval food-habits of this group of true flies. The list contains all of the facts already on record and a number of unpublished observations by the author. The grouping of the larval family habits in this way is of great interest. We notice that the author questions the parasitism of Lestophonus upon Icerya as well as of Leucopis upon plant-lice and scale-insects. There can be, however, no doubt as to the actual parasitism in both of these cases. Personal observations on the part of several entomologists besides our own, as already recorded, sufficiently prove this, and while skepticism is a good trait in a naturalist, it can serve no purpose when questioning well attested fact, upon no other grounds than generalization from group habit.

A BLOOD-SUCKING CHIRONOMID.

In *Psyche* for January, 1893, Prof. C. H. Tyler Townsend describes, under the name *Tersesthes* n. g. *torrens* n. sp., a minute gnat which he

has found in western New Mexico at an altitude of 7,000 feet, clustering in numbers upon horses and sucking their blood. The insect proved to be very interesting structurally and allied most closely perhaps to Ceratopogon, biting species of which are found throughout the northern states, and to Œcacta, a small blood-sucking gnat inhabiting Cuba.

THE FAMILY APIOCERIDÆ.

We have just received from the author, Dr. S. W. Williston, a brochure extracted from No. 3, Vol. I, *Kansas University Quarterly*, in which he strongly defends his position in considering that the dipterous genus Apiocera and its allies, Raphiomidas and Coquillett's recent genus, Apomidas, are deserving of family rank and are not to be included with the Asilidæ, Midaidæ or Therevidæ. In this view he takes up cudgels against no less an authority than Baron Osten Sacken, who considers that the group should form a subfamily of the Asilidæ. The paper is a very thorough and, to us, convincing argument in support of the views of the author, in which, by the way, he is supported by Mik and Brauer, the family having originally been founded by Macquart. It is worthy of note that in this paper Dr. Williston adopts for the first time J. B. Smith's terminology of the mouth-parts, and consequently the author's views of the homologies of these sclerites. He does this, however, with some slight reservation in the statement, "I believe that his studies show a real advance in knowledge of the homologies of these parts, though in some instances his views may require modification or change." To this paper the author adds two notes, one describing a new genus of Blepharoceridæ under the name Snowia and containing the species *S. rufescens*, and the other on the American species of Stylogaster.

The *Kansas University Quarterly*, from which this paper is extracted, bids fair to become a journal of some prominence. Its general form is excellent and it will undoubtedly possess considerable importance to entomologists, since not only Dr. Williston, but Chancellor Snow and his son, Mr. Wm. A. Snow, as well as Mr. V. L. Kellogg, will undoubtedly use its pages.

THE CALIFORNIA REMEDY FOR THE SAN JOSÉ SCALE.

As we have occasionally mentioned, the remedy which is in most frequent use for the San José Scale or Pernicious Scale (*Aspidiotus perniciosus*) in California, is the lime, salt and sulphur wash used upon deciduous trees. The old method of cooking the mixture in iron vats resulted in a fair incorporation of the ingredients into a whitewash. Mr. H. P. Stabler, of Yuba City, Cal., in a paper read before the January meeting of the State Horticultural Society and reported in the Pacific Rural Press of February 4, gives the details of some extensive and important experiments in the use of this wash. By means of a 12-horse power boiler and attached pipes, vats and hot-water tank he

cooked by steam 1,500 gallons of spraying material, boiling it in every case more than two hours. Fifty pounds of lime and 100 pounds of sulphur were placed in one of the vats (capacity 300 gallons) and 100 gallons of hot water were run in from the tank. Then turning on the steam the contents began boiling almost instantly. After two or three hours 150 pounds of lime and 75 pounds of salt were added, after having been previously slacked. The steam was kept up and the contents of the vats boiled for half an hour longer, and water was then added to make 300 gallons. After this prolonged cooking the residue was very slight and the mixture approached a chemical solution in appearance. The use of this mixture resulted in a complete eradication of the San José Scale from a 100-acre orchard of 7-year-old trees.

INTRODUCTION OF THE LONG SCALE INTO CALIFORNIA.

We notice from the *California Fruit Grower*, of December 10, 1892, that no less than 22 carloads of Mexican oranges have been imported into California at Los Angeles, many of them infested by *Mytilaspis gloverii*, which up to the present time has not succeeded in getting a foothold in that State. The *Fruit Grower* is justly indignant over the supposed negligence of the quarantine officers in allowing this importation, as these oranges coming before the California fruit is marketable were widely distributed and liable to work great damage. That neither the Purple Scale, Long Scale, or Chaff Scale have as yet obtained a foothold in California, in spite of frequent accidental importations, is by no means an absolute argument against the possibility that they might ultimately become injurious on the Pacific Coast, although this is a point made by importers both of fruit and nursery stock against the necessity of disinfection.

IMPORTED SCALES IN CALIFORNIA.

In a paper read by Mr. Alexander Craw before the State Horticultural Society, December 30, 1892, he brings forward many important facts relating to the insect pests of foreign trees. He states with great positiveness that the Red Scale of California (*Aspidiotus aurantii*) was introduced upon Citrus trees from Australia, and that it is undoubtedly a native of that country. Inasmuch as it can be traced to four distinct importations of trees from Australia and its spread followed from those centers, the first of his statements is probably correct, but it by no means follows that it is an indigene of the island-continent, and of this we have serious doubts. The so-called "yellow scale" (*Aspidiotus citrinus*), which, by the way, we have as yet been unable to separate specifically from the Red Scale, but consider only a variety thereof, is stated with equal positiveness to have been introduced from Japan in the early '70's. The San José Scale is stated to be unquestionably of foreign origin and it is surmised on the authority of Mr. John Brit-

ton, of San José, that it was introduced into California upon trees received from Chile by the late James Lick. This last is an interesting point which has not before been made public. We may mention, by the way, the fact that this scale has made its appearance within the last year in Australia. Other imported pests which are specifically mentioned are the Purple Scale (*Mytilaspis citricola*) and the Long Scale from Florida (*Mytilaspis gloverii*); the Florida Red Scale (*Aspidiotus ficus*) from Florida, Cuba, and Japan; the Chaff Scale (*Parlatoria pergandii*) from Florida, and an allied species, *Parlatoria proteus*, from certain islands of the Pacific; the Wax Scale (*Ceroplastes floridensis*) from Florida, and the congeneric *C. rusci* from Japan; *Ctenochiton perforatus* from Australia, and *Dactylopius iceryoides* from the same locality; *Dactylopius destructor*, the common Mealy Bug, from Honolulu, and *Pulvinaria camellicola* from Japan; the common Orange Chionaspis (*C. citri*), the most abundant pest of the Orange in Louisiana, from Japan and also from Australia; *Lecanium depressum* from Honolulu.

THE MEMBRACIDÆ OF NORTH AMERICA.

We are pleased to notice that Dr. F. W. Goding, of Rutland, Ill., has published in the Transactions of the American Entomological Society, vol. XIX, a synopsis of the sub-families and genera of the Membracidæ of North America, upon which he has been at work for the last few years. His tables will be very useful to the student of the Homoptera, and we look forward with interest to the complete monograph which Dr. Goding has in preparation.

A NEW ENEMY OF THE TOMATO.

In November, 1892, we received from Mr. G. W. Caruthers, of Bexar, Tex., specimens of an insect which he stated was damaging his tomatoes, and which had been very destructive to that crop in the neighborhood of Bexar for the past three years. Upon examination the insect proved to be *Pthia picta* Dr., which occurs normally in the West Indies and has been but seldom reported from the Gulf States. This, in fact, is the first time it has been reported as of economic importance. The insect is not distantly related to the common Squash Bug and will probably be as difficult to control.

AN INSECT ENEMY OF LACE CURTAINS.

In a short paper, "Biologic Notes on New Mexico Insects," in the *Canadian Entomologist* for January, 1893, Prof. C. H. T. Townsend records the fact that *Ceuthophilus pallidus* Thomas, a wingless stone cricket has been found in New Mexico in houses eating holes in lace curtains and other fabrics, and is reported to cause much damage in this way. This is an entirely new habit for an insect of this group, and we should naturally suppose, were it not for the frequency of the

occurrence which Prof. Townsend reports, that it was entirely accidental and abnormal. We have observed a common species of this genus in recently built cottages in the Catskill Mountains upon and behind straw mattings used as dados, and have noticed that it had gnawed the straw to some little extent. This habit, however, was certainly accidental, and we imagine the same to be probably the case in New Mexico.

LOCUSTS IN SOUTH AFRICA.

The scourge of locusts still continues in South Africa. The *Agricultural Journal* of the Cape Colony, published December 1, 1892, contains a tabular statement indicating the exact condition of affairs in the seventy-six divisions of the colony, from which it appears that the western, north-western, southern, and midland provinces have generally escaped, while the south-eastern, eastern, and north-eastern provinces, Griqualand and the Transkei, are more or less afflicted. The natives have been occupied in destroying large swarms in these districts, and the divisional councils have in most cases made small appropriations which have been supplemented by the government of the colony on the £ for £ principle. The destructive work is purely mechanical, and is done with brush. Although it is generally conceded that the injurious species is migratory, no attempt seems to have been made to define the permanent breeding grounds. The present incursion has lasted three seasons.

NORTH AMERICAN SPECIES OF HIPPISCUS.

Mr. S. H. Scudder has just completed a careful monograph of the North American species of this genus of locusts, which comprise some of our more injurious species. The paper has been published in parts in *Psyche*, running from June to December of the past year. The author has studied more than five hundred specimens, which he finds to represent thirty-eight species grouped under the sub-genera Hippiscus, Sticthippus, and Xanthippus. This is a difficult group of insects to separate, and Mr. Scudder has done a real service to working entomologists.

AN EXTREME CASE OF NORWAY ITCH.

The manifestations of the skin disease produced by *Sarcoptes scabiei* DeG., when especially severe, have been called by the medical profession *Scabies norvegicum* largely from the fact that the first case investigated by Hebra of Vienna occurred upon a Norwegian. An interesting case of this kind, occurring in this country, has just been described by Dr. Robert Hessler, of Indianapolis, in a paper read before the Indiana Academy of Science at its December meeting. The patient, a middle-aged white man, partly paralyzed, was admitted to the Indianapolis City Hospital, when it was found that his entire body was

covered with thick yellowish-white, leathery scales, the largest measuring over one inch in diameter, and over one-tenth inch in thickness. He was literally covered with scales like a fish. Upon cross-sectioning one of the scales itch-mites were found in abundance, and with proper treatment the mites were exterminated and the skin regained its normal character. An interesting calculation of the number of mites present on the host was made by Dr. Hessler. The estimate resulted as follows: Egg-cases and eggs 7,004,000; mites, 2,009,000. It seemed probable, however, that from one-half to three-fourths of the eggs had already hatched, while a comparatively small proportion of the mites were living at the time when the scales became detached. We are indebted to Dr. Hessler for some very fine microscopic mounts of cross-sections of the scales differentially stained with picro-carmine, which resulted in the epithelium taking the red color, the mites the yellow color, while the eggs remained unstained.

ON HARVEST SPIDERS.

Under the title "The Striped Harvest Spider" Dr. C. M. Weed gives an interesting study of specific variation in the December number of the *American Naturalist*, showing that *Phalangium vittatum* Say, and *P. dorsatum* Say, are inseparable upon structural details. After the study of nearly a thousand specimens Dr. Weed concludes that we have to deal here with a single very variable species in which natural selection has increased the size of the body and length of the legs in the south and shortened them in the north. The eggs of this species probably hibernate and the young of the northern form hatch in May and become mature the latter part of June or July. The young prefer the shelter of the grass, low herbage, and rubbish piles, and in Illinois are common upon corn, where, as Dr. Weed has surmised, they probably live upon the numerous small insects drowned in the moisture contained in the bases of the unfolding leaves as well as upon plant-lice. The article is illustrated by one page plate.

A CURIOUS PARASITE OF THE PELICAN.

Our correspondent, Mr. Alvah A. Eaton, of Riverdale, Calif., recently sent us specimens of lice which he had taken from the gular sac of the White Pelican, the accompanying note reading, "Bird killed this morning at 6:30. Laid in water with head under till 12:30. Lice alive and lively at the end of that time." The specimens were determined for us by Prof. Osborn as *Menopon consanguineum* Piaget. He writes us concerning the species as follows:

> I have seen it a number of times collected at different localities, and have taken numbers of them from two pelicans brought here about two years ago. I formerly referred the specimens to *M. titan*, with which it is very closely related, but Piaget has seen fit to erect for it a new species and the characters are probably of sufficient importance to justify his action.

He says (Supplement to Les Pédiculines, p. 117): "Sur un Pelecanus erythrorhynchus (Muséum de Leide). La parenté avec le *M. titan* est frappante; les détails présentent cependant assez de différences pour constituer espèce nouvelle. Ces parasites paraissent infester de préférence l'intérieur de la grande poche et se fixer à la peau de manière à ne pouvoir en être détachés sans effort. Notre espèce a peut-être quelque rapport avec le *M. perale*, découvert par Leidy sur un Pelecanus trachrrhynchus (Proc. Ac. Nat. Sci. Phil., 1878, p. 100). Malheureusement la description est trop peu détaillée pour permettre une comparaison."

I have not seen the description by Leidy, but it seems quite probable that it may prove to be the same, and in that case his description should have priority.

It seems to me that the species shows close affinity to *titan* and that the difference may be due to the habit this form has assumed of living in the gular pouch, a habit which would quite naturally entail some modifications. It seems to me also that there is probability that this habit is comparatively recent, and that there may be expected a further modification of details of structure to accommodate the species more perfectly to this novel habitat.

To the popular mind the habits of parasites on the surface of the animal are disgusting enough. What would some of our "highly cultured" friends think of a louse living in the mouth?

PROCEEDINGS OF THE ENTOMOLOGICAL SOCIETY OF WASHINGTON.

Volume II, No. 3, of the Proceedings of this Society was issued December 31, 1892. It contains articles by Messrs. Ashmead, Bergroth, Doran, Gill, Howard, Hubbard, Mally, Marx, Riley, Stiles, and Webster, all of which have been mentioned by title, with short abstracts, in the notices of the meetings of the society which we have given from time to time on the final page of the consecutive numbers of INSECT LIFE. The present volume includes the proceedings from January, 1892, to June, 1892. A short No. 4 will be published immediately, containing the Proceedings of the Society for October, November, and December, 1892, which, with the index, will conclude Volume II.

The society is in a flourishing condition, and comprises 30 active members and 83 corresponding members.

OBITUARY.

On January 2 the death of Prof. J. O. Westwood, honorary life President of the London Entomological Society and Curator of the Hope Zoölogical Collection at the University of Oxford, was announced. Prof. Westwood, whose name is known wherever the science of entomology is studied in the civilized world, had reached the ripe age of nearly 87 and was fortunately able to continue his entomological work to the end. The list of his publications is exceedingly long, not only on account of his long life, but also his activity as a worker. The work by which he is best known is his Introduction to Entomology, published over fifty years ago. This work is standard to this day and has probably done more to encourage good work among English-speaking students of entomology than any other published treatise. His investigations covered the entire field of entomology, and in all directions

his work has been characterized by painstaking care, almost absolute accuracy of observation, and by a power of deduction and generalization characteristic of a broad mind.

Our old friend and correspondent, Dr. P. R. Hoy, of Racine, Wis., one of the early members of the Entomological Club of the American Association for the Advancement of Science and an old-time collector and observer of the habits of insects, died recently at his home at Racine, at the age of 76. To entomologists Dr. Hoy will be best remembered from his connection with the investigation of the northern food-plants of *Aletia xylina.*

We have also to record the death of another distinguished English entomologist, Mr. H. T. Stainton, who died December 2, 1892, aged seventy. Among his many important contributions to entomology, the most notable are his Natural History of the Tineina, in four languages, with many plates, and his Manual of British Butterflies and Moths. He was a founder and to the end of his life one of the editors of the *Entomologists' Monthly Magazine*, besides being secretary for many years of the Ray Society, of the Zoölogical Record Association, and of Section D of the British Association. He was a fellow and at one time president of the Entomological Society, Fellow of the Linnean Society, and became F. R. S. in 1867.

THE MANNA SCALE.

At the meeting of the Entomological Society of France for December 28, 1892, Dr. A. Giard announced the discovery of specimens of *Gossyparia mannifera* Hardwick—the Tamarix scale-insect which furnished the manna of the Hebrews—in a sending of Prof. Trabut of the Medical School of Algeria. This is a wide extent of the range of this species, which had formerly been found only in Arabia, Russia, and Armenia. Dr. Giard considers the *Tamarix mannifera* of Ehrenberg to be probably identical with *T. gallica*, and calls attention to the fact that the name for the scale-insect suggested by Hardwick in 1822 having been *Chermes mannifer*, Signoret's adoption of the name *Gossyparia manniferus* was unjustifiable. He further states that the manna which Dr. Trabut has observed in abundance is certainly a production of the insect, and not a section of the parasitized plant.

A CURIOUS SEED-POD DEFORMATION.

Dr. Rose, of the Botanical Division of this Department, has handed us a herbarium specimen of an interesting leguminous plant from Mexico—*Desmanthus virgatus*—which normally gives off groups of from three to five narrow pods, averaging nearly three inches in length by one-eighth of an inch in width. We have found the seeds in these pods infested by *Bruchus bisignatus* and the Bruchus parasitized by a new

species of Cænophanes. The principal point, however, to which we wish to call the attention of the readers of INSECT LIFE is that certain of the seed-pod clusters are strangely modified by the work of a small Tortricid moth which we know as yet from the empty pupa shells only. Each pod is reduced in length to half an inch and swells out widely so as to produce a gall-like object radically dissimilar to the perfect pod. These pseudo-galls occur normally in clusters of five given off from a single stem and are well calculated to puzzle the botanist.

THE ZEBRA CATERPILLAR ON THE PACIFIC COAST.

According to Mr. J. B. Smith's "Revision of the Species of Mamestra" the common *Mamestra picta* of the vegetable gardens of the Eastern and Middle States is said to range west to Nebraska, and while the food-plants of the species have always been known to be rather general, it usually feeds upon annual plants like the Bean, Pea, Cabbage, Beet, Spinach, Aster, Honey-suckle, Mignionette, Asparagus, Clover, Lambs-quarter. Our California agent, Mr. D. W. Coquillett, however, received recently two colonies of larvæ indistinguishable from the Zebra Caterpillar, the one found on Apple and the other on Orange in southern California. From these specimens he reared a single male, which he forwarded to Washington and which we find to be identical with *M. picta*. We thus have not only a greatly widened geographical range, but two new food-plants from this observation.

ENTOMOLOGICAL SOCIETY OF WASHINGTON.

January 5, 1893.—The following new members were elected: W J McGee, J. B. Jones, and Frederick C. Pratt, active members; W. G. Johnson, Palo Alto, Cal.; J. W. Toumey, Tucson, Ariz.; C. H. Rowe, Malden, Mass., and Wm. H. Patton, Hartford, Conn., corresponding members. The distribution of No. 3, Vol. II, of the Proceedings was announced by the Publication Committee. Mr. Stiles opened the discussion of the president's address on parasitism, which was read at the previous meeting by Prof. Riley. He dwelt more particularly on Leuckart's classification of parasites and treated in detail parasitism by animals other than insects. General discussion followed on the address by Messrs. Fernow, Hubbard, Doran, Waite, Gill, Schwarz, Riley, and others. Under general notes and exhibition of specimens Mr. Schwarz spoke shortly on the food habits and distribution of *Silpha lapponica*. Mr. Hubbard remarked on the hibernation and food plant of *Chrysomela flavomarginata*. Mr. Ashmead exhibited a small Chalcidid representing a European genus not hitherto known to occur in the United States.

February 2, 1893.—The following persons were elected to corresponding membership: Rev. J. L. Zabriskie, Flatbush, L. I., and Mr. O. F. Cook, Huntington, L. I. A paper by Mr. Hubbard, accompanied by exhibition of specimens and entitled "Note on Brathinus," was presented by Mr. Schwarz. In this paper a new species from the Sierras of California is described as *B. californicus* and a synoptic table is given separating the three species now known. Mr. G. C. Davis, of Agricultural College, Mich., gave a general description of the character and extent of the insect collections of that institution. Mr. Howard presented a paper on a peculiar feature of

the Elasminæ in which he described minutely, with the aid of blackboard drawings, the peculiar arrangement of the spines on the hind tibiæ and tarsi of the Chalcidids of this subfamily. These spines, which are very minute, are so arranged as to make curious, but very regular figures which are of great value in the separation of species. Discussion followed by Messrs. Stiles, Ashmead, Schwarz, and others. Mr. Schwarz presented a paper entitled "A parasitic Scolytid," in which he described the galleries of an undescribed species of Crypturgus, which uses the galleries of another Scolytid as a starting point for its own galleries. The species will be described as *C. alutaceus*. The paper was illustrated by specimens and figures. Mr. Schwarz also exhibited a few northwestern Coleoptera, which have hitherto remained unidentified by American coleopterists. Mr. Stiles reported a case of spurious parasitism in a human subject. Before adjournment the Society was invited by Mr. Schwarz to examine three collections of Coleoptera of considerable local interest. These were made by Mr. Hubbard, at Lake Tahoe, Cal., in the Yellowstone National Park, and in the Bear Paw Mountains in northern Montana, and also by Mr. Schwarz and Mr. Hubbard in northern United States and Canada.

March 9, 1893.—Mr. Frank Benton presented a paper entitled "Curious defenses constructed by Meliponæ and Trigonæ," which was discussed at considerable length by various members. Mr. Riley presented by title, a descriptive paper on the genus Deridrotettii, with descriptions of *D. longipennis* and *D. quercus.* Mr. Schwarz presented a paper on the ovipositor in certain species of the Chrysomelid genus Donacia, illustrating his remarks by sketches and exhibition of specimens. The outer sheaths of this ovipositor were shown to be admirably adapted for the cutting or sawing of plant tissues, leaving little doubt that in the species provided with such ovipositor the eggs are inserted into the stems of aquatic plants. Mr. Schwarz exhibited samples of white and black insect pins made by Schlüter, of Baden, Germany, now on sale in this country, which he said were in his short experience a very superior article.

C. L. Marlatt,
Recording Secretary.

April 6, 1893.—Dr. George Marx read a paper entitled, "On Degeneration by Disuse of Certain Organs in Spiders," confining himself to a consideration of the disuse of two or four pairs of spinnerets in certain of the Drassid spiders which do not spin webs, and which need but two spinnerets for use in making the egg cocoon. Discussed by Messrs. Gill, Ashmead and Schwarz.

Mr. Ashmead presented a synopsis of the Spalangiinæ of North America, defining the sub-family and its component genera, remarking upon the distribution of species and host habit, and presenting in synoptical form the species which have hitherto been found in this country, together with a number of new forms. Discussed by Messrs. Howard and Smith.

Dr. J. B. Smith spoke informally concerning the Rabbit Flea, making some preliminary remarks upon an investigation which he had been conducting on the mouth-parts and male genitalia. His conclusions supported the view that the fleas do not form a family of the Diptera, but that the order Siphonaptera is justified. Discussed by Messrs. Stiles, Marx, Howard and Gill, the latter strongly supporting the conclusions of the speaker. Short notes and exhibition of specimens were introduced by Messrs. Stiles and Schwarz.

L. O. Howard,
Secretary pro tem.

U. S. DEPARTMENT OF AGRICULTURE.

DIVISION OF ENTOMOLOGY.

PERIODICAL BULLETIN. Issued July, 1893.

Vol. V. No. 5.

INSECT LIFE.

DEVOTED TO THE ECONOMY AND LIFE-HABITS OF INSECTS, ESPECIALLY IN THEIR RELATIONS TO AGRICULTURE.

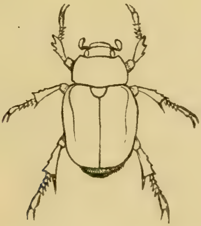
EDITED BY

C. V. RILEY, Entomologist,

AND

L. O. HOWARD, First Assistant,

WITH THE ASSISTANCE OF OTHER MEMBERS OF THE DIVISIONAL FORCE.



[PUBLISHED BY AUTHORITY OF THE SECRETARY OF AGRICULTURE.]

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1893.

CONTENTS.

SPECIAL NOTES.

The 1892 Report of the Official Entomologist of Canada.—Mr. James Fletcher's report as Entomologist and Botanist of the Experimental Farms of Canada occupies pages 144–167 of the Annual Report of the Director and Officers, recently published. The entomological portion of the report is shorter than usual, but includes several articles of importance. After a summary of the insect outbreaks of the year, Mr. Fletcher gives detailed attention to the Hop-vine Borer (*Hydrœcia immanis* Guen.), the Red Turnip Beetle (*Entomoscelis adonidis* Fab.), the Western Blister Beetle (*Cantharis nuttalli* Say), the Birch Bucculatrix (*Bucculatrix canadensisella* Chamb.), an egg-parasite of the Currant Saw-fly, and "some other useful parasites." The Hop-vine Borer, or "Collar worm of the Hop," is reported by certain Canadian hop-growers to be the most injurious insect in the hop yard, not even excepting the Hop Plant-louse. Mr. Fletcher's article on this insect is a carefully prepared summary of previous writings, but includes no suggestions of new remedies. The Red Turnip Beetle has done considerable damage during the past two years, in the northwest territory, and Mr. Fletcher gives a careful review of its life-history and recommends the Paris-green remedy. The Western Blister Beetle, together with other species of its family, did considerable damage in the northwest territory during 1892 and its extraordinary abundance is doubtless due, as in the United States, to the prevalence of locusts during the preceding year. The Birch Bucculatrix, which we treated on page 16 of the current volume, is reported to have been extremely abundant in the vicinity of Ottawa. The egg parasite of the Currant Saw-fly is a species of the genus Trichogramma, and the other parasites reported are: Another species of the same genus within the eggs of the Imported Willow Saw-fly (*Nematus pallidiventris*); *Pimpla ellopiæ*, Harr., reared from the chrysalides of the Vancouver Island Oak-looper; an undescribed species of Telenomus from the eggs of this last species; *Trichogramma pretiosa* and a new species of Telenomus from the eggs of the Zebra Caterpillar, and *Apanteles congregatus* from the larvæ of both the Tomato worm (*Protoparce celeus*) and the Lesser Grape-vine Sphinx (*Ampelophaga myron*).

An Important Publication on the Mediterranean Flour Moth.*—M. J. Danysz, of Paris, to whose preliminary work on *Ephestia kuehniella* we have recently referred, has just published a completed account of his recent investigations of this destructive insect in the shape of a sixty-page illustrated pamphlet. Mr. Danysz's treatment of the subject comprehends a careful résumé of former publications, an extended discussion of the question of the origin of the species, and a most careful consideration of its life history and remedies. It will be remembered that European authors, with the single exception of Miss Ormerod, have hitherto considered that this insect is of American origin, and that it has been imported into Europe with American cereals. In our article published in vol. I, No. 6, of INSECT LIFE we protested against this haphazard conclusion, but with little effect upon European authors who have since discussed the matter. After a careful review of the arguments brought forth by European writers, Mr. Danysz concludes that it is unsafe to point to any one country as the original home of this insect. He is inclined to think that it was originally a very widespread species, and that it comes into prominence as a pest in flour mills at intervals when circumstances favor. He places no reliance upon the idea that it is being or has been imported in numbers from America into Europe. He calls attention to the fact that the first appearance of the insect in Germany in 1877 was at Halle, an inland town, and that its first appearance in France was also at a point far inland. Its first appearance in France, moreover, occurred prior to its first appearance in England, and he concludes that the natural course of an importation from America would have been exactly the reverse of what he shows to have been the case. Moreover, Mr. Danysz has collected two important bits of information from two practical millers, one of whom remembers that this same insect made its appearance in 1872 in large steam flour mills in Constantinople; that it was destructive for two years and then disappeared. The other individual states positively that he has known the insect in the vicinity of Paris for more than fifty years, and that he remembers having seen a serious case of damage as early as 1840.

We have given this evidence this attention for the reason that certain extremists have argued that it is necessary to quarantine American wheat before allowing it to enter France. The absurdity of such a regulation is shown by the fact that at the present moment this insect is known to exist in no milling establishments in the United States with the exception of one or two in San Francisco, and in these the insect was never known prior to 1892. The Canadian outbreak which we mentioned in our original article was the only one ever known in

*_Ephestia kuehniella_, Parasite des Blés, des Farines, et des Biscuits. Histoire Naturelle du Parasite et Moyens de le détruire. By J. Danysz. Mémoires du Laboratoire de Parasitologie Végétale de la Bourse de Commerce, Vol. I, 1893. Paris, 1893.

North America prior to this appearance in San Francisco. The remedial measures recommended by M. Danysz are summed up as follows:

(1) Thoroughly to insufflate the mill with a powder composed of pyrethrum strengthened with nicotine, whenever the moths are seen, especially at these three times of the year: April–May, July–August, and October–November; that is to say, at the times when the moths issue from the cocoons in the greatest numbers.

(2) To whitewash the ceiling and walls of the mill, as well as the interior walls of the apparatus, at least once a year, in May.

(3) To clean regularly, or at least twice a month, the conduits of the elevators and especially those which carry the refuse away, by means of specially devised brushes.

(4) To disinfect the empty sacks by subjecting every one either to the action of heat or of bisulphide of carbon for at least twelve hours continuously.

Legislation Against Insects.—A summary of the laws which have been enacted by corporations at different times and in different countries for the enforcement of measures against destructive insects would furnish some very interesting comparative data. Still more interesting, however, would be an intelligent statement of the results which have followed such legislation. The paucity of beneficial results resulting from sound enactments may be due either to the inefficiency of the officers appointed to carry out the law, or to popular prejudice against the legal provisions and a consequent tendency to shirk and evade them where possible. Both causes almost invariably coöperate. The fact of comparatively poor success in the past, however, should not be used as an argument against wise legislation and an attempt to enforce it. We have frequently had occasion to advise restrictive legislation, and more frequently to urge coöperative work on a large scale, but regret to state that only in a comparatively few instances has this advice been followed to such an extent that the fullest good has been accomplished. Too often the *laissez faire* policy has intervened. Yet we continue our work, having faith in human nature and particularly in the intelligence of the average American citizen. We prefer active opposition to total indifference, but it is more discouraging still to have the merit of a suggestion accepted by intelligent persons who, nevertheless, refuse to assist in carrying it out for the reason that they fear that indifference and carelessness on the part of others will interfere with complete success.

As an instance in point, a prominent California horticultural and agricultural journal, after reprinting in full our article upon the Potato Tuber Moth (*Lita solanella*), in commenting on our advice relative to the necessity for strenuous efforts to stamp out the insect, goes on to state that it is not reasonable to suppose that the work will be done or that it is possible to accomplish it even if all potato-growers do their duty. The case is cited by the editor principally as an instance "of the little good that may be expected from the enforcement of anti-pest quarantine laws." It is true that the result of attempts at insect legislation in

California may justify this pessimistic view; but the horticultural and agricultural press should encourage rather than discourage all attempts to lighten the burden of the farmer. It is faulty logic to argue that because a thing has not been well done it can not be well done. Should this hasty expression of opinion on the part of the individual editor convince one or two persons critically situated that it is not worth while to attempt to stamp this pest out, it is quite within the bounds of possibility that an irreparable harm may be done to the entire potato-growing interests of the country. At the time of publication of our article this new pest was apparently limited in this country to a small area. Immediate energetic efforts would have at least retarded its spread and might have brought about its practical extinction. It was a matter for the town corporation of Bakersfield to take at once in hand, and it was important that every individual potato-grower in that neighborhood should at once do his best to destroy the insect. The carelessness or indifference of one, however, would vitiate to some extent the well meant and energetic efforts of many. Hence arises the desirability, in fact the necessity, of stringent local laws and their thorough enforcement.

The Codling Moth and Hop Louse in Oregon.—In Bulletin 25, of the Oregon Agricultural Experiment Station, published April 1893, Mr. F. L. Washburn publishes a short report of his work during 1892 with the Codling Moth and the Hop Louse. Experiments in spraying against the former pest were conducted with flour paste and Paris green, Paris green alone, I. X. L. and soap, I. X. L., Paris green, and soap. The flour paste mixture was found unsatisfactory, while the others were of a reasonable degree of efficacy. Mr. Washburn finds that the Codling Moth has three broods in Oregon, and publishes an interesting table of dates of transformations. The proper time for the first spraying in an average season in Oregon is the first week in June.

Under the head of the "Hop Louse" the author concludes that kerosene emulsion is not a safe insecticide in the hands of the Oregon hop-growers. This is contrary to the opinion expressed by the same author a year ago, and is based upon the fact that the average grower fails to make the mixture properly. A remedy which is unhesitatingly recommended is a solution of soap and tobacco, which is much cheaper than the quassia mixtures and less dangerous than the kerosene emulsion while almost equally efficacious. It may be well to mention in this connection that Mr. Koebele, one of the California agents of this Division, was sent to Oregon and Washington in May for the purpose of demonstrating the ease with which a satisfactory emulsion may be made, and of giving a practical illustration of the methods recommended by this Division for the destruction of the Hop Louse. It is as yet too soon to report results, but it may be stated that, so far as his experiments

have gone, Mr. Koebele confirms results obtained by the Division in the New York hop fields in 1887. While it is undoubtedly true that other mixtures may be applied more safely to the crop while in the burr, the enlightened hop-grower will never allow his yard to be infested as late in the season as this. Preventive work on neighboring plums should come first. Then, if by chance the yard becomes stocked from plum trees at a distance, all insecticide work should be done about the time of the disappearance of the migrating generation. Thorough work at this time will obviate the necessity for any further labor.

The insect portion of this bulletin is followed by some account of gophers and moles, with the remedies to be used against them. The remedies mentioned are exclusively in the line of traps and poisoned food, the excellent bisulphide of carbon treatment, which has been recommended for some years by the Division of Economic Ornithology and Mammalogy of this Department, and which forms the subject of a recent bulletin by Mr. Niswander of the Wyoming Station, being ignored.

Insects Injurious to Crops in England in 1892.—Our friend and correspondent, Mr. Charles Whitehead, in his capacity of technical adviser to the intelligence branch of the Board of Agriculture of Great Britain, has just published an interesting and well-illustrated report upon the insects and fungi injurious to crops in 1892 in that country. Most of the species treated are distinctively European, but American readers will be interested in what he has to say about the Grain Aphis (*Siphonophora granaria*), the Turnip Aphis (*Aphis brassicæ*), and the Cabbage Fly (*Anthomyia brassicæ*), as well as the Red Spider (*Tetranychus telarius*), although little or nothing new is brought out. The colored plates accompanying the report are especially good, that illustrating the Apple-blossom Weevil (*Anthonomus pomorum*) being particularly interesting to us at the present time on account of the striking similarity between the work of this insect and the work of our Strawberry Weevil (*Anthonomus signatus*).

The Bud Moth.—Mr. Slingerland has given us, in Bulletin 50* of the Cornell Station, an admirable summary of the facts concerning *Tmetocera ocellana*, a well-known orchard pest of the northeastern States. He deals with its past history and classification, the indications of its presence, its general appearance, its life-history, its natural enemies, and the best methods of preventing its ravages. He shows from experiment that Paris green spray applied at the time the buds are begin-

* Bulletin 50, Cornell University Agricultural Experiment Station, Ithaca, N. Y., March, 1893. By Mark Vernon Slingerland.

ning to open will reach the insects so satisfactorily that no further remedy need be desired. The best proportions for central New York are one pound of the poison to 150–200 gallons of water.

The Cattle Tick.—Bulletin 24* of the Texas Agricultural Experiment Station, deals with the subject of the Cattle Tick, publishing in full a somewhat elaborate paper by Dr. Cooper Curtice, formerly connected with the Bureau of Animal Industry of this Department, upon the biology of the Cattle Tick, and following this with a short account of the preventive measures in use at the station, written by Dr. M. Francis of the station staff. Dr. Curtice's account is in the main a summary of investigations made while he was still connected with the Department, and is largely a repetition of a paper read before the Biological Society of Washington in 1891. It is an admirable summary of the literature and life-history of the insect, the latter from original observations, and it is illustrated by two plates drawn by Mrs. J. H. Comstock, of Ithaca, N. Y. Dr. Curtice sums up his conclusions under six heads, as follows:

(1) The ticks were probably brought with the cattle either from southern Europe or northern Africa.

(2) The life-history of the tick is, 1st, an egg; 2d, a six-legged seed-tick; 3d, an eight-legged asexual nymph; 4th, an eight-legged adult.

(3) Ticks dropping off where cattle are confined or spend the most time, more especially in their resting places, cause these places to be most infested with the young.

(4) Ticks are associated with a disease attacking cattle, and their removal has prevented the disease being communicated.

(5) By taking advantage of the climate and the use of remedies, cattle and certain pastures may be freed from the ticks.

(6) All cattle intended for transportation to northern fields and markets should be freed from ticks.

The recommendations of Dr. Francis consist in the application of any one of several patented sheep dips, diluted with 98 per cent water. He states, but without showing why, that the kerosene emulsion fails to satisfy the demands. The patented mixtures recommended are Cannon's, Hayward's, and Little's sheep dips. An apparatus for the easy application of the dip has been devised, and is figured. It consists in elevating a barrel of the mixture on a derrick 16 feet high. From the barrel runs a pipe which divides into five branches, each provided with a short piece of hose and a tin rose. Another hose for hand use is let into the main pipe above the branches. The derrick is built above a slanting platform, which collects the dip as it runs off the animal treated into a barrel sunk in the ground, whence it is pumped up to the elevated barrel for repeated use. The animals to be treated are successively driven under the derrick and the dip turned on, the hand-

* Bulletin 24, Texas Agricultural Experiment Station, Bryan, Tex., 1892.

hose being used to apply the liquid to the brisket, between the thighs, etc. With this apparatus about thirty animals per hour can be treated, at a cost, including material and labor, of five cents per head.

Injurious Insects in Cape Colony.—The March number of the Agricultural Journal, published by the Department of Agriculture of Cape Colony, contains what appears to be the first instalment of a series of articles upon insects injurious to fruit by Mr. S. D. Bairstow, whose name will be familiar to the readers of our reports as that of the gentleman who first discovered the helpful ladybird *Rodolia iceryæ*, the principal African enemy of the Fluted Scale, and sent it to England, where it was named by the late O. E. Jansen. In this instalment of this important series, Mr. Bairstow considers *Heliothis armiger* and *Carpocapsa pomonella*. The first of these insects is treated from an entirely new standpoint, that is, as an enemy to peaches. The popular name as given at the head of the article is "The Boll Worm or Corn Worm of the southern United States—the Peach Under-wing of the Cape." The eggs seem to have been laid in great abundance upon the young peaches in the town of Cradock in the fall of 1892. On one tree bearing 190 peaches no less than 73 larvæ were found. Each larva, not satisfied with tunneling and destroying the one peach upon which its attack commenced, made its exit upon the side opposite to that of its entry and then entered and destroyed a second and even a third young fruit. The species was determined by Mr. Roland Trimen, of the South African Museum, so that there can be no doubt as to the accuracy of the name. The remedies given by Mr. Bairstow are hand-picking and spraying with Paris green.

The consideration of the Codling Moth brings out little that is new. This cosmopolitan pest was found doing great damage to pear orchards at Graaff-Reinet during the past winter. We gather from the article that this is considered to be a new and more or less local occurrence of the Codling Moth in Cape Colony, and the importance of stamping it out at this point is insisted upon by Mr. Bairstow, who states that the fruit-growers there have a responsibility almost all their own in preventing a widespread calamity. The Codling Moth, however, as pointed out in Mr. Howard's article in our annual report for 1887, has been known in South Africa for a number of years, so that local work will have hardly more than local effect. The Paris green treatment and the banding methods are recommended.

Miss Eleanor A. Ormerod's Sixteenth Report.—The Sixteenth Report of observations of injurious insects and common farm pests of this well-known writer upon agricultural entomology has just reached us. It is

as usual from the press of Simpkin, Marshall, Hamilton, Kent & Co., Limited, London, and is on sale at eighteen pence, which barely covers the cost of publication. It comprises Miss Ormerod's observations on the injurious insects of the season of 1892, a remarkable summer on account of the abundance of many of the common insects. The principal damage was done by the Leaf-eating Pea-weevil (*Sitones lineatus*) upon Pea, the caterpillars of the Silver-Y Moth (*Plusia gamma*) on Clover, the Hop "Strig Maggot" (*Cecidomyia* sp.) on Hop, the Leaf Maggot on Mangold crops, the Corn Aphis (*Siphonophora granaria*) upon Wheat, and the Diamond-back Moth (*Plutella cruciferarum*) upon Turnips, and various root diseases of Cabbage and Tomato, several of the latter being figured in excellent photo-lithographic plates. A number of comparatively new insect attacks are mentioned. Considerable space is devoted to the Apple Sawfly (*Hoplocampa testudinea*) which was treated in her last report, the Cabbage-stem Weevil (*? Baridius* sp.), the Yellow-legged Clover Weevil (*Apion flavipes*), Mites (*Tyroglyphus longior*) in Hay, the Currant-shoot and Fruit Moth (*Incurvaria capitella*), the Pigmy Mangold Beetle (*Atomaria linearis*), the Mustard Beetle (*Phædon betulæ*), the Onion Fly (*Anthomyia ceparum*), Orchard Caterpillars (*Cheimatobia brumata*), Red Spider (*Tetranychus tiliarum*), Strawberry-leaf Beetle (*Galeruca tenella*), and sundry important eel worms receive detailed notice. The usual painstaking and accurate personal observations are recorded, and the whole is presented in Miss Ormerod's lucid style. The private publication of sixteen of these valuable reports is an instance of philanthropic work which is not equaled in any other country by any entomological worker.

Bulletins 45 and 46 of the Ohio Agricultural Experiment Station.—Prof. F. M. Webster has just published an author's edition of his portion of Bulletins 45 and 46 of the Station to which he is at present attached, and includes accounts of insects affecting the Blackberry and Raspberry and of underground insect destroyers of the wheat plant. The first of these articles is a complete résumé of our knowledge concerning the insects affecting these two plants and is fully illustrated. Mr. Webster's own observations are inserted here and there, and the compendium as a whole is a valuable one. Under the title of the second paper he gives accounts of wire-worms, white grubs, Southern Corn Root-worm (*Diabrotica 12-punctata*), and of the crane-flies, the latter article being extracted with some changes from his report as agent of this Division for 1891. The author's edition is printed on excellent paper, and the pamphlet is a creditable one.

Some Diseases of Cotton.—Bulletin 41 of the Alabama Agricultural Experiment Station reached us early in April. It bears the title "Some

Diseases of Cotton," and while none of the diseases treated are strictly entomological all who have studied the insects of cotton will find matter of interest in this pamphlet. Nine distinct pathological troubles are described and figured, the root gall produced by Anguillulidæ being the only one of animal origin.

Noctuidæ from the Death Valley.—We publish in this number some descriptions of new Noctuidæ from the Death Valley, by Prof. J. B. Smith, which were prepared too late for use in the general report on the insects of the Death Valley published in connection with Dr. Merriam's report. The plate accompanying this descriptive paper is from a photograph made by Prof. Smith, and is in the nature of an experiment in this line of illustrating. There is included in the photographs a very pretty species of Antaplaga, which we have named after Mr. Koebele, who did the insect collecting of the expedition, and a description of the species is therefore added to Prof. Smith's paper.

THE PRESENT YEAR'S APPEARANCES OF THE PERIODICAL CICADA.

We call attention to the localities in which this curious insect will doubtless appear the present summer. Two different broods, one a 13-year and the other a 17-year brood will appear and will have been making the woods resound with their peculiar song in their respective localities before this number of INSECT LIFE is received. We shall be exceedingly obliged to any readers or correspondents who will send us word of the occurrence of this insect in their own locality, or any facts additional to those here indicated, or any information that tends to confirm, correct, or amplify the records. We should like particularly to have exact data as to the limits of the appearance in any particular township or county.

BROOD XVI—TREDECIM (1880–1893).

In the First Report on the Insects of Missouri the senior editor established this brood solely on the testimony of Dr. G. B. Smith, from the single locality of southern Georgia. Since then he has obtained confirmatory proof of its existence not only in Georgia but in other parts of the south. It is now known from four States, but the special localities are much scattered and this fact is due, in all probability, to want of more careful observation, or to the incompleteness of reports. It is obvious, however, from the localities given below that this Brood XVI is confined to the southern States and does not extend into the Mississippi Valley.

It may be further noted that this brood is the forerunner of the largest 13-year brood known, viz, Brood XVIII (1881–'94), which occupies the Mississippi Valley, as well as the southeastern States. These two broods occupy, in fact, the same relation to each other as do the small 13-year Brood VI (1884–'97), and the second largest 13-year Brood VII (1885–'98), although Brood VI is confined to the southern part of the Mississippi Valley. The localities so far known for Brood XVI, which appears the present year, are as follows:

Alabama.—The following very definite statement was received in 1885 from Mr. William M. Garrett, Mount Willing, Lowndes County: The 13-year Locust will not make its appearance in this county until 1893. Your correspondent can remember their appearance in 1841, 1854, 1867, and 1880. There are no 17-year Locusts in this county.

Tennessee.—Mr. W. F. Rass, of Fayetteville, Lincoln County, wrote us as follows in 1885: "The Cicadas gave us a call in 1880, whether of the 13- or 17-year varieties I have no means of finding out, but I do know that they were very numerous." This locality is on the southern line of the State, and falls within the territory of this Brood and not within that of the 17-year Brood XV, which also appeared in 1880.

Georgia.—Cherokee County, according to Dr. G. B. Smith (not yet verified). Cobb County, as indicated by Mr. H. M. Hammett, of Marietta, who wrote us in 1885:

"In 1880 there was a considerable quantity of the Cicadas in this county. They made the woods ring and did some damage to fruit trees."

North Carolina.—Mr. F. B. Shuford, of Holly Springs, Miss., wrote us on June 18, 1885: "I recollect they (the Cicadas) were in Lincoln County, N. C., about 1828." This is an indefinite statement, which needs verification. Mr. D. B. McIver, Moore County, N. C., reported that Cicadas in 1880 were "in the piney woods of this county, but not in the oak woods."

BROOD XI—SEPTENDECIM (1876–1893).

This is an old-established and well-known brood, though much remains to be learned regarding its extent, and a few of the reported localities need verification. As in some of the other 17-year broods, and more especially Brood XXII (1885–1902), the present one occurs in two divisions or branches, the eastern branch (in North Carolina and Virginia) representing the bulk of the brood and the western branch being broken up into several well-separated detachments. Compared with other 17-year broods, Brood XI is of rather southern distribution, *i. e.*, its northern limit, so far as known at present, is the mouth of the Shenandoah River, the western detachments following nearly the same latitude (about along the 39th parallel). In its southern extension along the Alleghany Mountains it is only exceeded by Brood XXII, but it occupies a considerable area in North Carolina and Virginia well toward the east of the mountains which is not the case in Brood XXII. It always appears one year in advance of another well-known 17-year brood viz, Brood XII (1877–'94), and there is evidently a relation between the two, for a glance at the territory occupied by both shows that Brood XII is the northward continuation of Brood XI, extending along the eastern flank of the Alleghanies as far north as Albany and Troy in New York. South of the Potomac the two broods do not exactly overlap, but run parallel with each other. Brood XI occupies the valley of Virginia west of the Blue Ridge and a strip halfway between the mountains and the ocean, whereas Brood XII occupies a rather narrow strip along the eastern flank of the mountains through Virginia to northern North Carolina. The following is the list of the localities known for Brood XI, the majority of them (already published in Bulletin No. 8 of this Division or previously) being here repeated without further comment:

North Carolina.—From Raleigh, Wake County, to the northern line of the State; also in the counties of Rowan, Davie, Cabarrus, and Iredell.

Virginia.—From near Petersburg, Dinwiddie County, to the southern line of the State; Bedford County; Valley of Virginia west of the Blue Ridge from the Potomac River on the north to the Tennessee and North Carolina lines on the south.

District of Columbia.—Noticed, the present year, early in June, in the woods north of Washington and along Rock Creek.

Maryland.—Southern half of St. Mary's County.

Kentucky.—Trimble County, in the northern part of this State, has been added to the localities occupied by this brood on the strength of the following communication by Mr. W. J. Parker, Bedford, Trimble County, dated June 25, 1885: "My first remembrance of the visitation of the Cicada was in 1855, when they were very numerous; then they appeared again in 1859 and again in 1872." The years 1855–'72 plainly

refer to the 17-year Brood VIII, while the year 1859 can only be referred to our Brood XI.

Indiana.—Counties of Sullivan and Knox. To these is probably to be added Posey and adjacent counties, since Mr. J. B. Elliott, of New Harmony, wrote us in 1885: "The Cicada appeared in great numbers over the whole of this (Posey) and adjacent counties in 1859." There is some doubt about these localities in extreme southwestern Indiana, for they come very close to the region known to be occupied by the 17-year Brood VII, which appeared in 1859.

Illinois.—About Alton, Madison County.

Kansas.—From this State, which was hitherto not included in the region occupied by this Brood XI, we received in 1885 the following statements, the first from Mr. E. M. McKinnon, Leavenworth, Leavenworth County, being as follows: "The only locusts I ever saw here appeared in 1859, and they destroyed a young orchard of mine which was one of the earliest set out here (in 1857)." The second communication is from Mr. John W. Robson, of Cheever, Dickinson County: "During the latter part of May, 1876, the Cicadas appeared in large numbers along the banks of the Smoky Hill River. They were so noisy and so numerous that the majority of the settlers were alarmed for the safety of their crops. These fears in some measure were allayed by two articles which I published in the county press." Both statements are quite definite and can only be referred to this Brood XI. Thus the counties of Leavenworth and Dickinson, Kans., have to be added to our list.

Colorado.—Cheyenne Canyon. We would have no hesitation in rejecting this locality, which is separated from the eastern forest region by a long stretch of open prairie land, if it were not based upon the authority of an experienced entomologist, viz, the late Mr. V. T. Chambers (see Amer. Entom., III, p. 77). Still we can not refrain from suspecting a confusion with some other species of Cicada.

FURTHER NOTES ON YUCCA INSECTS AND YUCCA POLLINATION.*

By C. V. Riley, Ph. D.

PRONUBA MACULATA.

Since the presentation a year ago of the communication on "Some Interrelations of Plants and Insects," in which I summarized what was then known of Yucca pollination and the Yucca moths, some further interesting observations have been made, and the facts which I have to present tonight should be looked upon as additional to those set forth in the previous paper (Proc. Biol. Soc. Washington, vol. VII, pp. 81–104). On account of the singular structure of *Yucca whipplei*, which was known to be pollinated by *Pronuba maculata*, I was quite anxious to obtain the facts in reference to this species. The long stamens, the sticky and abundant pollen, and the peltate stigma, are characters which would seem to facilitate ordinary pollination, though the restricted style would render this more difficult and the peculiarities of *Pronuba maculata* with its modified tongue, and maxillary tentacles very long and attenuated at tip, were, I felt quite sure, special adaptations to fit it for its work. This Yucca is not only one of the most interesting from the structure of its flower, but is one of the noblest of the cespitose species and placed in the subgenus Hesperoyucca. The flowers are borne in immense panicles on a stalk, which arises directly from a crown of

* Read before the Biological Society of Washington, May 20, 1893.

YUCCA WHIPPLEI.

leaves near the ground and reaches sometimes a height of twelve feet or more, and I present herewith a photograph which very well illustrates the magnificence of some of the larger specimens (Fig. 38). At my request Mr. D. W. Coquillett, of Los Angeles, Cal., made some special observations last year on the pollination of this species, and on the 12th of June he was able to witness the operations both of oviposition and pollination on a plant while yet the sun was shining brightly about forty minutes before setting. The act of oviposition does not differ in any particular from that which I have already described in detail for *Pronuba yuccasella.* The pollen is deliberately gathered and a mass nearly half the size of her head is held under the neck by the coiled tentacles. In pollinating, the tentacles are uncoiled and stretched so that the tips may be inserted into the upper part of the stigma. Mr. Coquillett describes the process of thus pollinating the stigma as lasting about half a minute, after which the insect that he watched descended the ovary and at once mounted to the top of one of the stamens. Here, with her tentacles, she removed both pollen masses (moving her head from side to side during the operation) and added the pollen thus gathered to the mass which she was already carrying. She went to two other stamens in succession, gathering a pollen mass from each. Mr. Coquillett in communicating his observations remarks that "it was indeed surprising to witness the evident intelligence which this insect displayed in all her actions wherever the pistil of the flower became pollinated solely through her own labors, and that she went through these maneuvers with the evident intention of pollinating the flower appears to admit of no doubt."

A number of insects have been observed associated with the flowers of *Yucca whipplei*, but none of them, as observed by Mr. Coquillett, acted in any way to produce pollination, either intentionally or by accident. As a check to prove the influence of Pronuba on the production of fruit, I desired Mr. Coquillett to inclose another panicle and exclude the moths. We were both somewhat surprised at the result, namely, that a certain number of the pods set on this panicle; and this would prove that (so far as a single experiment justifies conclusion) the species is capable of a certain amount of self-fertilization.

So far as they go, Mr. Coquillett's observations on the actions of *Pronuba maculata* agree very well with those of Prof. William Trelease, who made a special trip through the Southwest, in the spring of 1892, with a view of studying the pollination of those Yuccas which had not hitherto been studied in this connection. He has published a most interesting article in the Fourth Annual Report of the Missouri Botanical Garden, entitled "Further Studies of Yuccas and their Pollination." This is, in fact, a most valuable contribution to our knowledge of the subject, and is complementary and additional to my own paper published in the annual report of the same series for the previous year.

Mr. Trelease's life-studies of *Y. whipplei* have added materially to our understanding of its floral characteristics. The anther cells, on dehiscing, contract so as to expose the pollen freely, but the contents of each cell forms a "rather consistent, two-lobed moist mass, which is held by its lower part, but protrudes prominently from the open anther." The ovary is free from the longitudinal depressions which in the other Yuccas usually correspond with the appressed stamens. The capitate stigma is slightly indented at the center "and covered with long, hyaline, delicate papillæ, which are always moist with abundant secretion, that at length becomes almost gelatinous over the middle of the stigma." He found the nectar apparatus well developed, the septal glands though narrow reaching commonly to the base of the ovary, with a conducting groove of corresponding size. The glands are also, though smaller, more active than in most other species of Yucca studied by him. Prof. Trelease also notes that the characteristics of this flower would seem to make it easily self fertilizable, and remarks on the exceptional occurrence in the lower part of the Cajon Pass of a few plants with more or less abundant, partly developed, but unusually diminutive capsules, in which no evidences of Pronuba action were to be found, and this, added to the experiment made by Mr. Coquillett, would seem to indicate that where Pronuba is absent *whipplei* has the same exceptionally limited power of fructification, whether by self-pollination or pollination by other agents, that we know to be possessed by *aloifolia* among the true Yuccas. Recognizing this possibility, Prof. Trelease was somewhat surprised to find that, with the single exception which he noted, no fruit, among all his observations, was discovered which did not clearly show the work of Pronuba.

From his account, as well as that of Mr. Coquillett, it appears evident that *Pronuba maculata*, in accordance with the greater tendency of the flowers of *whipplei* to open during the day, is more diurnal in habit than *Pronuba yuccasella*, carrying on the acts of oviposition and pollination during the day. Further, unlike the other Pronubas so far known, this species rests with the head toward the stigma, and when disturbed is very apt to drop suddenly from the flower and take wing. I can not do better than quote verbatim Mr. Trelease's interesting account of the act of pollination, that of oviposition being, as already stated, absolutely the same as in *yuccasella*.

When the moth is about to deposit an egg she usually moves about in the lower part of the flower much as the other species do, commonly dragging the tip of the ovipositor along the parts she walks on as if wiping off extruded secretion, but also seemingly using it as a tactile organ while she assumes the position best suited to oviposition, which is nearly the same as that taken while at rest. Standing on the side of the pistil, she then bends the abdomen sharply forward so as to bring the ovipositor to about the middle of the ovary, which she pierces at the thinnest part, namely, about 1^{mm} from the septal groove. As a general thing not more than six eggs are laid in a given pistil—one on either side of each septum—and frequently the number is smaller than this, so that even if they all hatch, which is not likely to be the case, there is rarely more than one larva to each tier of seeds, and con-

sequently a fair percentage of the seeds are allowed to come to maturity. In the very succulent white ovary the puncture made in laying an egg is usually seen easily immediately after the ovipositor is withdrawn, and a rather large drop of clear sap not infrequently exudes from it within a short time.

Having withdrawn the oviduct, in doing which she moves up so that her head is about level with the stigma, or even before this organ is entirely freed, the moth usually proceeds to pollination; but it is not infrequent for two eggs to be laid between each two visits to the stigma, and, owing to her peculiar alertness, she appears to be even more easily frightened into omitting pollination than are the other species of Pronuba. Standing with her head at about the height of the stigma, with the short tongue projecting out in front, she uncoils her long tentacles from the compact mass of pollinia—which she carries similarly to the other Pronubas—only that small part of her burden which adheres to the bases of the tentacles being removed from it, and, raising her body on tiptoe, she very slowly saws the tentacles back and forth across the top of the stigma, generally following one of the three shallow grooves, and very carefully working their slender tips into the more or less gummy exudation over the central depression. Sometimes the operation is interrupted long enough to admit of the tentacles being coiled back against the load of pollen and again extended; but the curious manner in which her head is held back from the stigma as a rule prevents any of the main load from reaching even the marginal papillæ.

On first witnessing this operation, I was impressed by the much slower motion of the moth than usual and the evident care which she took to run the ends of the tentacles into the central depression of the stigma, which I then supposed to be solid; the subsequent discovery of the stylar canal, communicating with the ovarian cells, showed that it is into this narrow passage that she so carefully guides the tips of her tentacles with their modicum of pollen, and no doubt the abundant stigmatic secretion serves not only to foster the development of the nascent pollen tubes after pollination, but, wetting the tentacles, aids in the disintegration of her mass of pollinia. These, if really related to her work, would seem to have acquired their coherent structure as a means of facilitating their collection, rather than as an adaptation to their removal bodily from the anther to the stigma as is the case in orchids and asclepiads, where, however, special means of secure attachment to the insect accompany this aggregation of the pollen grains into a large mass.

A further interesting fact connected with the pollination of this species is that Prof. Trelease discovered a purely black variety (which he describes as *aterrima*) of *Pronuba maculata* connected with the variety *graminifolia* (Wood) of *Yucca whipplei*, common in San Bernardino county. The actions of this black variety are similar to those of the typical form, and it is also diurnal rather than nocturnal in its movements. The method of gathering the pollen mass is thus described:

Flying into a flower the moth runs about the bases of the stamens after the manner of other species, then quickly clambers upon the inner side of a filament, and, with the tentacles extended over the pollinia, drags first one and then the other out of the anther cells, pressing them together under the throat, and subsequently compacting the mass together, much as *yuccasella* does the powdery pollen of other Yuccas, so that the ball finally consists of as many as ten or a dozen pollinia. So quick and energetic are the motions by which the pollinia are removed that the stamens are often shaken quite violently, as I have before noted in the more nervous attempts of *yuccasella*.

PRONUBA YUCCASELLA ON THE PACIFIC COAST.

Of the fleshy-fruited Yuccas, among others, Prof. Trelease was able to study *Yucca baccata* Torrey, which is pollenized by *Pronuba yucca-*

sella. While he was not able to observe the acts of pollination, all the circumstances and the facts which he obtained would indicate that it is precisely the same as described for other species of Yucca that are fertilized by this moth, and the fertilized flowers show "conclusively that the pollen is thrust well into the stigmatal canal," or in some cases apparently even into "the top of the ovarian cells, which owing to the short style and the deep stigmatic notches, they [the moths] can reach easily with their long maxillary tentacles." The moths taken from flowers at Cabazon and San Diego are somewhat above the average in size, with the horny and chitinous parts somewhat darker than in the typical form, but specimens which he sent me can not be considered to have even varietal differences and find their counterparts in my cabinet in specimens from Dakota and Colorado.

Yucca rupicola Scheele, of southern Texas, and *Y. elata* Engelm., extending from southern Texas to southern Arizona, are both pollinated by *Pronuba yuccasella*, as Prof. Trelease ascertained.

PRONUBA SYNTHETICA.

Mr. Trelease was also fortunate enough to be able to study the operations of *Pronuba synthetica* on the flowers of *Yucca brevifolia*. This Pronuba is slower in its movements and slower to take flight than the other species observed, though he found it more active during the day than his *Pronuba yuccasella*. It takes wing less readily, and then merely sails down to the ground. This indisposition to leave the flower may be connected with the almost constant high winds on the Mojave Desert, where this yucca most abounds. The fertilized pistils of this Yucca are quite noticeable by comparison with those of other species by their symmetry and lack of constriction or indentation, so uniformly present in the Yuccas that are punctured by *Pronuba yuccasella* and *P. maculata*. The explanation is found in the fact that *Pronuba synthetica* pierces "the uppermost part of the style, conveying its eggs down to the ovary through the stylar channel, the course followed by the pollen tubes." This fact interested me very much, for I recollected very well in my first studies of *Pronuba yuccasella*, before the act of oviposition had been witnessed, that—puncturing for the purpose of oviposition being unrecorded and therefore quite exceptional among Lepidoptera—I was strongly of the opinion that the egg would be thrust through the stigmatic opening down the stylar channel. The instinct to oviposit only on the youngest flowers is particularly marked in *synthetica*, which Trelease frequently saw forcing itself into the narrow clefts between the rigid sepals of the opening bud, the flattened form of the insect facilitating the operation. This habit also suggests the cause of the looseness of the wing scales and the ease with which they are lost. Mr. Trelease's observations in detail on the actions of this Pronuba can not well be condensed, and I quote them entire:

When about to deposit an egg, having selected a suitable flower, the female of *synthetica* runs to the bottom of the stamens much as *yuccasella* does, makes a rapid

more or less complete circuit of their bases, and then quickly ascends to the very top of the pistil, her thorax rather higher than the end of the stigma, and with her short but strong ovipositor cuts through the thin wall into the stylar channel, rarely as much as 2^{mm} below the tip of the stigma, meantime holding fast to the pistil, the stamens being below her reach. The long extensile oviduct is then passed through the puncture, the egg being laid apparently within the ovarian cell, along the funicular end of the ovules. In removing the oviduct the moth not infrequently carries her body across the stigma, so that at first sight she appears to be withdrawing it directly from the mouth of the stylar canal; but I have never seen her make direct use of this canal. The operation consumes more time than does the oviposition of either *yuccasella* or *maculata* as I have observed them, and usually takes altogether from two-and-a-half to three minutes. Sometimes two or more eggs are laid before the stigma is pollinated, but commonly after laying each egg the moth retreats to the bottom of the flower and then again ascends the pistil until her head is brought even with the stigma, when she uncoils the large tentacles from their resting place against her load of pollen and passes them back and forth in the stigmatic chamber, with almost the same motion as the eastern species, usually making use of one of the stigmatic notches. While so employed she carries the rather short tongue almost straight out above the stigma, but I have never seen her make any use of it to force the pollen into the latter, nor has she been observed to attempt to feed on the slight stigmatic secretion nor to search for food at the base of the flower, where, if anywhere, the nectar of the septal glands should be found.

Prof. Trelease has not yet published anything upon the other species of Yucca insects which he has collected, and I take this occasion to present some few unrecorded facts in reference to some of the species of Prodoxus which he was kind enough to send me, as also some additional data from other sources.

THE SPECIES OF PRODOXUS.

Prodoxus coloradensis.—This was described by me from a single male taken in 1884 by Mr. H. K. Morrison in Colorado. In April, 1892, Mr. F. V. Coville, the present Botanist of the Department of Agriculture, gave me a few small pieces of the flower stem of a Yucca, infested by a Prodoxus larva. The plant was collected in the Charleston Mountains, Lincoln county, Nevada, the previous February, and was undoubtedly *Yucca baccata*. From these pieces of stem I reared early in the present month two imagoes, which proved to be *Prodoxus coloradensis*.

I have also received from Prof. Trelease four other collected specimens, rather battered and imperfect, which belong to this species, all taken from the flowers of *Yucca baccata* at Banning, Cal. These two bred specimens are constant, and agree thoroughly well with the type, except that there is no inclination to pale yellowish in the white scales of the head, and the thorax shows some black scales on the tegulæ, a line of black around the collar, and, in one of the specimens, along the middle of the thorax; characters not noticeable except in well preserved specimens. The white portion of the antennæ extends also in these two specimens beyond the basal third and fully to one-half the length of the organ. The four collected specimens from Prof. Trelease indicate considerable variation; in one specimen the outer arm of the transverse Y band across the posterior portion of the wing being absent,

while in another it is broken, as is also the basal portion of the median band. The same is true of the band across the middle of the wing, while the upper portion of this band is connected with the basal band. The larva shows no striking characteristics, but is very similar to most other Prodoxid larvæ, being uniformly yellowish white, the head and cervical shield anteriorly slightly darker, the ocelli black, and the mandibles brown and three-toothed.

Prodoxus reticulatus.—One of the specimens received from Trelease taken in flowers of *Yucca whipplei*, variety *graminifolia*, at Arrowhead Springs in California, would indicate that this species, which I described from three females from Los Angeles county, Cal., and the habits of which were not known, breeds in some part of this Yucca. The single female sent by Trelease is interesting, in that it shows some variation in the direction of *coloradensis*, especially by the separation of the basal half of the W-shaped band.

Prodoxus cinereus (Fig. 38).—A section of the flower-stem of *Yucca whipplei*, sent me by Mr. Coquillett last July, contained a number of different larvæ, and among them most numerously one which subsequently proved to be the larva of *Prodoxus cinereus*. We have known that this species breeds in the main stem of this Yucca, but none of the early states had been observed. The larva is remarkable in that it differs materially from the typical Prodoxus larva. It is first of all very much more elongate, with the sutures between the segments strongly impressed. It is, further, more uniform in diameter than the typical Prodoxus larva; but the most striking feature is the anal segment, which bears on its ventral plate two stout, brown, decurved horns resembling those of the larva of Trogosita in Coleoptera, except that these are curved in the opposite direction. I add a technical description:

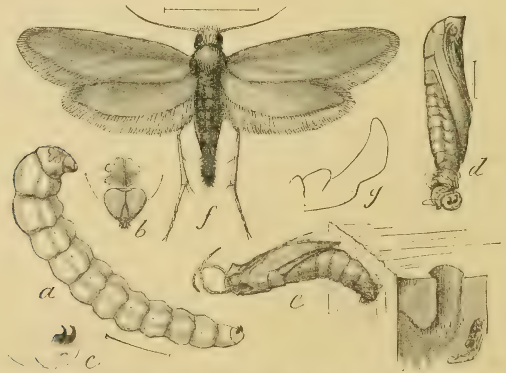


FIG. 38. *Prodoxus cinereus: a*, larva; *b*, head and first thoracic joint; *c*, anal hooks; *d*, pupa; *e*, pupa shell protruding from stalk; *f*, adult female; *g*, side view of clasper of adult male; *a*, *d*, *e*, and *f* enlarged; *b*, *c*, and *g* still more enlarged. (Original.)

PRODOXUS CINEREUS. *Larva* (Fig. 38*a*).—Average length when full-grown, 8.25mm; body elongate, but slightly curved, the joints moniliform; head rather large, more horizontal, and more free than in other species, light brown in color, darker anteriorly; borders of clypeus almost white; pigment spot around ocelli, and the mandibles dark brown; the Y-shaped lines distinct and having exactly the outline of a rather narrow wine-glass; cervical shield pale, but fuscous around the borders and especially at the middle of the anterior border; sinuate laterally and cleft posteriorly by the pale mesial line; characteristic feature is a pair of decurved, dark, horny anal hooks, situated on the ventral apex; anal plate but faintly chitinous and with a fuscous mark upon it; a sub-ventral depressed line but faintly indicated, and more highly polished than the rest of the surface: spiracles extremely small, with a faint yellow annulus, the pro-thoracic pair situated on the sub-ventral depressed line, the others much higher up on the anterior third of the segments; no thoracic legs, but slight tubercles in place of them; general color faint bluish-green or yellowish-green, losing color, however, in alcohol.

Pupa (Fig. 38*b*).—Offering no peculiar structures of importance, but presenting the characteristics of the other species of the genus. Skin very delicate; the cephalic projection not very prominent and the anal tip absolutely smooth; dorsal spinules reduced almost to obsolescence. The shrunken larva skin with its two strong hooks remains attached to the tip of the body of the pupa, and doubtless serves to hold it secure when it pushes from the surface of the thin epidermis to give forth the imago.

The imagos issued from the 11th of April to the 8th of May, the antennal sheaths and leg sheaths of the pupa separating, the former curling very much as in other lepidopterous pupæ which have wood- or pith-boring larvæ.

Prodoxus ænescens.—Prof. Trelease has sent me a full account of the oviposition of this species upon *Yucca whipplei*, and it corresponds in every particular with the oviposition of *Prodoxus decipiens* in the east. In this case the species is not confined to one or the other of the forms of *whipplei* but occurs on both the typical form and the variety *graminifolia.*

Prodoxus intermedius.—This species was described from two female specimens taken in Texas and one taken in Colorado, in 1887. It is a most interesting form, bearing an even more deceptive resemblance to *Pronuba yuccasella* than does the much commoner *Prodoxus decipiens.* For though the female lacks the remarkable maxillary tentacles of Pronuba, the ovipositor is long and delicate, very much as in the latter species. I have been anxious, since publishing the original description, to obtain a male of this rather puzzling species, and, fortunately, Prof. Trelease sent me specimens associated with the females. On a superficial examination the males of this species would be separated with great difficulty from the males of *Pronuba yuccasella;* but upon denuding the genitalia the differences at once appear, and it is curious to note that while the form of the genitalia, though showing slight variation, corresponds with that of *Prodoxus decipiens*, yet the claspers agree more nearly with those of *Pronuba yuccasella* in having but the one large tubercle.

Prodoxus intricatus n. sp.—I recently received from Mr. J. T. Mason, who has been kind enough to observe and collect some of the Yucca insects for me, a number of specimens of a Prodoxus, which he found in the flowers of one of the tree Yuccas in Jalapa, Mexico. He sent also

flowers and sections of one of the leaves of the Yucca, which, from this material, appears to be, without much doubt, *Yucca guatemalensis*. The moths were found abundantly in the flowers, but unfortunately reached me in rather dilapidated condition. The species is of the same general size as *Prodoxus reticulatus*, and with a somewhat similar, but more varied and less distinct maculation. It is, however, a much darker species. I would simply characterize the species here by comparison with *reticulatus*, with a view of adding one more link in our knowledge of the Prodoxids associated with the different species of Yucca.

In size and general appearance most nearly related to *P. reticulatus*, the general color, however, more sordid, the lighter shades inclining to pale fulvous, with a slightly golden sheen. Primaries more acuminate at apex, and marked with black scales, taking on, in a very general and indefinite way, the pattern of those of *reticulatus*. Secondaries also more acuminate at tip, and blacker. Fringes of all wings black. Under surfaces fuliginous, with the faintest trace of pale marks on the costa of primaries. Anal claspers of male short, recurved upward, with a rather angular production on the inferior margin, and with three minute, but distinct, black teeth. There is also a similar black tooth on the inner margin near the tip. Ovipositor of female similar to that of *reticulatus*.

Some of the darker specimens present an almost black appearance, the black marks inclosing narrowed, luteous spaces, which appear like so many spots.

Described from 20 males and 5 females, none of them in perfect condition.

CONCLUSIONS.

The additional facts which I have thus presented upon this subject of Yucca insects and Yucca pollination serve to confirm the generalizations which I have already indulged in. So far as variation is concerned they add still further links to the chain of alliances between the different forms of this interesting family, Prodoxidæ. The black form of *Pronuba maculata* presents us with the question of varietal or specific value that has arisen with the plant itself upon which it occurs, so far as regards the variety *graminifolia* of *Yucca whipplei*. Most specialists would be inclined, without any intermediate specimens, to characterize this black form as a distinct species, especially as it is dissociated from the other more typical forms and confined to one particular variety of Yucca. Yet in every other character but color it agrees precisely with the typical *maculata*, and I am strengthened in my view of considering it a mere variety by the well-known variation in the maculation of the typical species. It is a form that is differentiated as to color without having yet acquired any essential structural differences, though it may have lost the power to intercross with the typical form. Here, also, the color must be looked upon as of secondary importance to the species, and more or less fortuitous, as it is difficult to see what advantage the purely black has over the maculate form, especially in an insect essentially diurnal.

So it is in the variation of the banded species of Prodoxus. Some of

the specimens combine the characters of at least two different species, without being referable to either, satisfactorily, and in the present state of our knowledge most entomologists would be justified in describing them as distinct species; but there can be little doubt that when abundant material from different localities is obtained all these transversely-marked forms will be difficult to separate. Such, however, is the case in almost every genus, whether of plants or animals, and the Prodoxids simply furnish us with a rather marked illustration of the fact that the variation has gone on and is going on, so far as purely colorational characters are concerned, without any very definite and unchangeable differences having yet been acquired. How strikingly such facts compare with the permanency, even in colorational characters, of such well-established species in the same order as the cosmopolitan *Vanessa cardui*, which, with a most beautiful wing design and a most complex colorational pattern on the inferior surfaces, remains essentially constant in all its details in all parts of the world where it is known!

The decurved hooks in the larvæ of *Prodoxus cinereus* are also most interesting from an evolutional point of view. Such anal hooks are extremely rare in Lepidopterous larvæ, being found in only a very few pith-boring or stem-boring species.*

We have in this structure, which is so exceptional in Lepidoptera, another illustration of a principle to which I have often referred in my writings, namely, that larval structure in insects has been modified independently of the ultimate structure and is, as a consequence, of very little taxonomic value. Thus we have in the same family the larvæ of a Prodoxus (*e. g.*, the typical *decipiens*), which remain in their short burrows, possessing no legs; while those of Pronuba, which quit their burrows and penetrate the ground, possess thoracic legs. Yet in the particular case of *Prodoxus cinereus* the larva approaches Pronuba in having thoracic tubercles which may be looked upon as either remnants of legs or the beginnings of the development of such. This larva burrows in the soft pith of *Yucca whipplei* much more freely than any of the other species of the genus so far studied, making much longer

---

*I have not had time to closely scan the literature for cases of this kind, but do not recall any. I am familiar, however, with three unrecorded instances, two of them of Pterophorid larvæ which bore the stems of Solidago. One is the larva of *Alucita kellicottii* Fish, which singularly departs from the typical Lepidopterous larva in its elongated body and in having a pair of supra-anal spines which give the anal plate an appearance characteristic of that of many Coleopterous larvæ. The second case is that of an undescribed species of the same family Pterophoridæ, which has the anal plate obliquely truncate and fringed with a row of stiff hairs, and with a pair of small thorns at its ventral border, this modification also recalling that possessed by several wood-boring Coleopterous larvæ. The third case is that of the larva of a Noctuid, *Hadena stipata* Morr., which burrows in the pith of young corn or maize. It has the anal plate obliquely truncate and flattened along the posterior margin, which is armed with a series of horny points, and thus again repeats the structure which recurs in certain Coleopterous larvæ, especially of the Elateridæ, which inhabit burrows in the trunks of trees.

channels, the substance of the stem being less firm than that of the other species of Yucca. In so far, therefore, as this particular Prodoxus larva has peculiar structures we can trace their origin to purely dynamic influences, assisted by heredity and selection—a consequence, in other words, of environment—and repeated independently in larvæ of different orders having no possible genetic connection.

The distribution of the genus Pronuba as exemplified in these additional observations is extremely interesting. *Pronuba yuccasella*, the typical species of the genus, not only occurs over half the continent, as I have previously shown, but extends to the Pacific coast, and is found as far south as San Diego, showing over this wide range absolutely no differences that would justify varietal designation. All the characters are absolutely the same, and the rather dark coloring of the horny and chitinous parts of the body in the California, Dakota, and Colorado specimens would indicate that the western forms have this peculiarity as compared with the eastern. This species is now known to pollinize all the true Yuccas so far studied, and accompanies them across the continent. It thus pollinizes *Yucca filamentosa* and its several forms in the northeast; *Y. gloriosa* and *Y. aloifolia* in the southeast; *Y. angustifolia* (*glauca*) in the Rocky Mountain regions; *Y. rupicola* and *Y. elata* in the southwest; and *Y. baccata*, which connects the territory of *Y. angustifolia* with that of *Y. brevifolia* and *Y. whipplei*. It thus occurs in the same territory as its two congeners, *Pronuba synthetica* and *P. maculata*, with its *aterrima* variety, while these last are restricted to their respective Yuccas. This fact, as Prof. Trelease has pointed out, strengthens the inference that *brevifolia* and *whipplei* are primary Pacific coast types, while *baccata* is an immigrant from the east. It remains yet to observe the pollinizers associated with *Yucca filifera*, *Y. australis*, *Y. treculeana*, and *Y. guatemalensis*, each of which will probably have a distinct Pronuba, while the other Yuccas not enumerated here will probably not have distinct species connected with them.

It would carry me too far to speculate further on the additional facts brought forth, but I would urge in conclusion that in all Mr. Trelease's interesting observations in his special studies of these different species of Yucca, and after having paid particular attention to the point, he has failed to see a single Pronuba in any species attempt to feed on either the stigmatic secretion or the septal nectar. He was also unable to convince himself that in any case the insect makes use of the tongue in pollination, as he once thought it might. In this and other respects he fully confirms the conclusions which I have drawn in my previous communication to the Society, while the additional data which I have indicated give further force to my remarks upon variation, as exemplified by these Prodoxids.

ON THE POLLINATION OF YUCCA WHIPPLEI IN CALIFORNIA.

By D. W. Coquillett, *Los Angeles, Cal.*

In *Yucca whipplei* all of the leaves are borne next the ground, and the flower-stalk, which sometimes attains a height of twelve feet, is naked except for the small, scarious bracts. The flowers are in a dense panicle, and are borne on the upper third of the flower-stalk. The flowers are pendulous, and of a pure waxy whiteness within, the outside being more or less tinged with green; the form is rotate-spreading, or somewhat saucer-shaped. The stamens are as long as, or slightly longer than, the deeply-lobed ovary, including the short, conical style and large stigma. The latter is hairy-papillose, and is of a deep green color, contrasting strongly with the pure whiteness of the other parts of the flower. The stamens are almost as spreading as the perianth, and each one is surmounted by a pair of pollen-masses inclosed in thin membrane, which finally splits in two and falls away, leaving the viscid pollen-masses still adhering to the top of the stamen. After pollination has taken place the ovary increases in size, the perianth and stamens wither and finally fall away, and as the ovary or seed-pod continues to grow it gradually turns around, so that from its pendulous position it finally becomes upright, and remains in this position until ripe, after which it splits open, allowing the seeds to escape. This Yucca has about the same distribution in California as *baccata*, but to the eastward it extends only as far as Arizona. The California Indians feed upon the juice of the young plants, and also roast them for food. With this species, unlike the two other kinds mentioned above, the entire plant dies after flowering, although before this takes place one or more young plants usually start out from the base of the old one. The flowering season usually extends from about the first of May to the middle ot August.

As Dr. Riley has shown, the Tineid moths, *Pronuba maculata* and *Prodoxus pulverulentus*, live in the larva state, the former in the seeds and the latter in the seed-pods; while *Prodoxus marginatus*, *P. cinereus*, and *P. ænescens*, live in the flower-stalks and petioles of *Yucca whipplei*. There are six other kinds of insects which I have observed to live at the expense of this plant. The largest of these is a showy red and black Cerambycid beetle, *Tragidion armatum*, the larvæ of which live in the dead and dry flower-stalks; the beetle is quite rare, but is occasionally met with in mid-summer, resting upon the green flower-stalk in the daytime. The largest weevil known to me to occur in California feeds upon the green flower-stalks of this Yucca, usually taking up its position low down upon the plant, where it is more or less hidden from view by the leaves; this is the *Scyphophorus yuccæ*. A much smaller weevil, the *Macrorhyncolus protractus*, lives in the dry flower-stalks. The three remaining insects referred to belong to the Hemiptera, and I have thus

far found them only upon the leaves, the juice of which serves them as food. The first of these is a small brown Capsid known as *Halticotoma valida;* the second, a curious Homopterous insect, *Ticida cingulata*, of a brownish color, banded with white; the third and last is a Coccid, *Pseudococcus yuccæ*, having the general aspect of the common mealy-bug of our hothouses.

Certain other kinds of insects, notably locusts, are occasionally found among the leaves of this Yucca, but as they have not been observed to feed upon this plant, their presence upon it appears to have been purely accidental, and not for the purpose of obtaining food.

The following is a list of the insects that I have observed within or among the flowers of *Yucca whipplei:*

Hymenoptera:
- *Platylabus sp.?*

Lepidoptera:
- *Laphygma frugiperda.*
- *Pronuba maculata.*
- *Prodoxus marginatus.*
- *Prodoxus æneseens.*

Diptera:
- Genus? Species? Family Geomyzidæ.

Coleoptera:
- *Aleochara sp.?*
- *Hippodamia convergens.*
- *Anthonæus agavensis.*
- *Carpophilus pallipennis.*
- *Acmæops falsa.*
- *Diabrotica soror.*
- *Diabrotica trivittata.*

Hemiptera:
- *Aphis sp.?*
- *Thamnotettix scutellata.*

Neuroptera:
- *Chrysopa sp.?*

Of these, the *Laphygma* was present in three examples, but only at night, and may have been attracted by the light from my lantern, since they did not attempt to feed upon the flowers. *Diabrotica soror* was observed to feed upon the pollen-masses as well as upon the perianth. The Aphids were congregated upon the outside of the flowers. I did not observe a single butterfly or wild bee of any kind visit these flowers, although all of these insects were quite abundant in the vicinity where these observations were made. And the same observation also applies to humming-birds. *Pronuba maculata* and the two species of Prodoxus were present during the month of June and a portion of May and July; but none were observed after the 24th of July. The Prodoxus moths usually rested upon the inside of the perianth, but the favorite position of the *Pronuba* was resting upon the side of the ovary, her head turned toward but not reaching the stigma.

In 1892, at the request of Dr. Riley, I paid particular attention to the pollination of this Yucca and the actions of *Pronuba maculata.* After repeated watchings, both during the daytime and at night by the aid of a lantern, I was fortunate enough to witness the process of egg-depositing and pollinating. This was on the 12th of June of the present year. The sun was only about forty minutes high, but was shining brightly, and a cool breeze was blowing at the time. The Yucca plant was about eight feet high, and the flowers in the lower three-fifths of the panicle

alone were open. Upon approaching this plant I saw a Pronuba enter one of the opened flowers and take up a position on one side of the ovary, her head being directed toward but not quite reaching the stigma. She now pressed the top of her body against the ovary in the bottom of the groove over which she was standing, and appeared to be inserting her ovipositor into the tender ovary. She remained in this position for fully ten minutes, then she walked up the ovary and style until her head was slightly above the upper surface of the stigma, after which she stretched out her maxillary tentacles and repeatedly pressed their tips into the upper surface of the stigma, moving her head back and forth as she did so. Previous to this the tentacles had been held resting against a mass of pollen nearly half the size of her head, which was attached to the under side of her head. The process of thus pollinating the pistil lasted about half a minute, after which she descended the ovary and at once mounted to the top of one of the stamens until her head was slightly above the anthers or pollen-masses; then with her tentacles she removed both pollen-masses, moving her head from side to side during the operation, and added the pollen thus gathered to the mass already attached to the under side of her head. Next she ascended two of the other stamens in succession and in a similar manner removed a single pollen-mass from each of them, then took up a position on one side of the ovary and rested from her labors.

It was indeed surprising to witness the evident intelligence which this insect displayed in all her actions whereby the pistil of the flower became pollinated solely through her own labors. That she went through these maneuvers with the evident intention of pollinating the flower appears to admit of no doubt. She evidently did not gather the pollen to serve as food for herself. The small quantity of food which she requires during the few weeks of her existence could easily be taken direct from the stamens if she required pollen for food. Nor could the operation of pressing the tips of her pollen-besmeared tentacles into the stigma have any connection whatever with the taking of food, since these organs are no better fitted for taking up liquid food than her feet are, and the proboscis was not brought into use during this operation. The entire operation detailed above was evidently performed for the express purpose of providing food for her offspring which were to live in the seed-pods; and there also appears to be no doubt that she was in possession of the fact that unless she *did* thus pollinate the flower, there would be no seed-pods for her offspring to live in.

Wishing to ascertain if any other agency besides the Pronuba could effect the pollinating of the flower of *Yucca whipplei*, I inclosed the flower-bearing portion of five of these plants in thin muslin sacks on the 12th of June of the present year; none of the flowers on any of these plants had yet even partially opened, and I carefully removed all the insects from these plants before putting on the sacks. On the 24th of the following July I removed the sacks of two of these plants; one

of the plants bore four seed-pods, while upon the other were two dozen of these pods, each containing perfect seeds. The "march of progress" had obliterated the remaining three plants which I had inclosed in sacks, the plants having been uprooted and burned in order to give place to an olive grove. In the case of the two plants above mentioned, pollination had evidently been brought about by the repeated blowing of the sacks against the expanded flowers. In nature, of course, no condition like this exists, and it therefore seems very evident that, but for the kindly office performed by the Pronuba, *Yucca whipplei* could not exist.

THE COCOANUT AND GUAVA MEALY-WING.

(*Aleurodicus cocois* Curtis.)

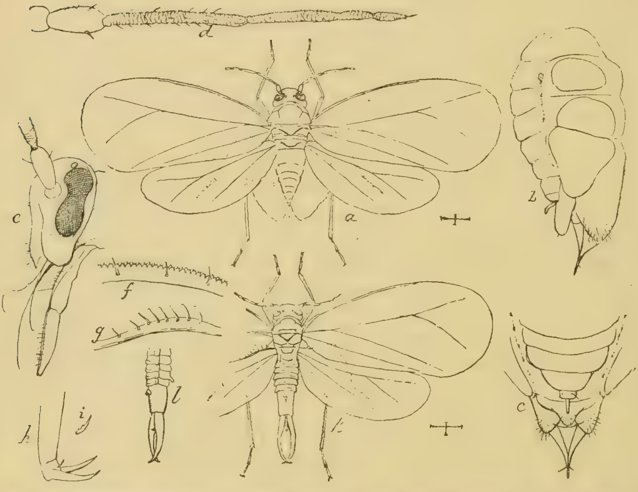


FIG. 39.—*Aleurodicus cocois* Curt.: *a*, adult female; *b*, side view of abdomen; *c*, dorsal view of same; *d*, antenna; *e*, head from side; *f*, costa of front wing; *g*, costa of hind wing; *h*, tarsus; *i*, pulvillus; *k*, adult male; *l*, claspers—*a*, *k* enlarged; others still more enlarged (original).

Under his well known pseudonym "Ruricola," John Curtis described in the *Gardeners' Chronicle* for May 2, 1845, a new Aleyrodid from the leaves of the Cocoanut trees in Barbadoes. The specimens were sent him by Sir Robert Schomburgk, who stated that to its work is attributed a widespread disease of the cocoanut which at that time threatened to destroy all of the trees on the island. The disease showed itself after the fatal hurricane of 1831, and at the time of writing there were few trees not affected by it. Cocoanut plantations which formerly yielded an income

of $1,000 to $1,500 per year had at that time not a single tree which bore fruit. The lower leaves die first and fall off, the flowers fall, or the nuts, if they have been formed, dwindle away and do not arrive at maturity. Ultimately budding leaves are attacked and the crown drops off, leaving the withered trunk. This work, however, was not to be attributed entirely to the Aleyrodid, since a bark-louse occurred also upon the leaves. Curtis described the former insect as *Aleyrodes cocois*, and accompanied his description by a fairly recognizable figure of the larva and adult male and of the abdomen of the female.

In the *Entomologist's Monthly Magazine* for February, 1892, Mr. J. W. Douglas, in connection with an article by Mr. A. C. F. Morgan, erected for this and one other species, the genus Aleurodicus, the principal character separating it from Aleyrodes being the bifurcation of the median nervure of the wings. The locality given is Demerara.

Up to the present time this insect has been found only upon cocoanut palm, but we have to record its recent appearance upon Guava in the Island of Trinidad. The cocoanut injury alone would have been sufficient to warrant the presentation of some account of this species in this journal, since the growth of the cocoanut palm as a fruit crop in south Florida is fast reaching considerable importance; but the fact that the species attacks Guava also adds to the insects importance. Several species of the genus Psidium, including a number of varieties of Guava of economic importance, are now grown in Florida and the industry is increasing. Up to the present time, as we notice from Mr. H. E. Van Deman's report on the condition of tropical and semi-tropical fruits in the United States, no insect enemies of the plant have been known in Florida.

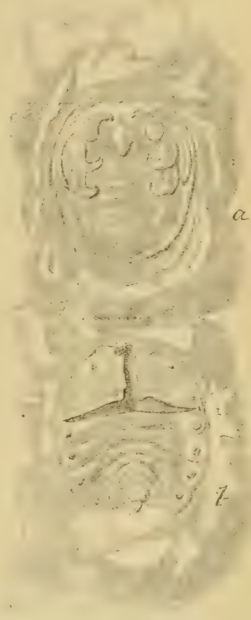


FIG. 40.—*Aleurodicus cocois* Curt.: *a*, full-grown larval skin from below; *b*, same from above—enlarged (original).

The injury which this new insect is doing in the West Indies seems to be considerable, and its importation into Florida is probably only a question of time, if not already brought about. The Guava is even less fitted to withstand the attacks of a rapidly spreading species like this than is the cocoanut-palm; and there is, therefore, every reason to forewarn Guava growers of the appearance and habits of the insect.

The Trinidad specimens which we have received (through the kind-

ness of Mr. H. Caracciolo, of Port of Spain) were mostly dry and in their natural positions upon the leaves, so that we have not been able to trace the entire life history of the species. We have made out several of the stages, however, which we illustrate herewith. The insects cluster mostly upon the undersides of the leathery leaves and form dense masses along the ribs, the more advanced specimens being furnished with an abundant waxy secretion giving a general mildewy appearance to the surface, while the upper surface is frequently attacked by a smut fungus which is developed on the honey dew thrown down from the undersides of the leaves above. Cocoons of a species of Chrysopa appear frequently in the masses and two species of lady-birds of the Scymnid group have been found feeding upon the lice. The honey dew attracts numerous ants, and one species which Mr. Caracciolo has sent us has been determined by Mr. Pergande as *Prenolepis longicornis.*

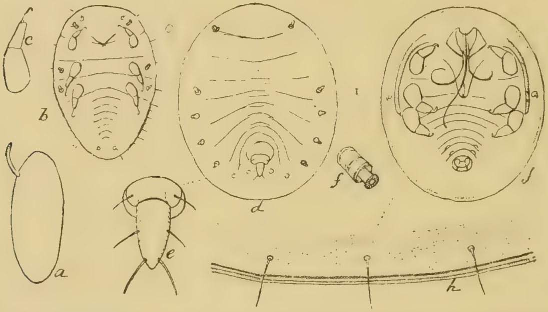


FIG. 41.—*Aleurodicus cocois* Curt.: *a*, egg; *b*, first larva; *c*, leg of same; *d*, intermediate larva, dorsal view; *e*, protrusile organ of same; *f*, secretory pore of same; *g*, intermediate larva, ventral view; *h*, margin of body of same—*a*, *b*, *d*, *g*, enlarged; *c*, *e*, *f*, *h*, still more enlarged (original).

ALEURODICUS COCOIS Curtis.

The Egg (Fig. 41*a*).—We know the egg only from specimens taken from the bodies of gravid females. Length, 0.29^{mm}; greatest width, 0.11^{mm}; length of pedicel, 0.064^{mm}. From these measurements it will be seen that the egg is broader in proportion to its length than that of *Aleyrodes citri*. The pedicel, instead of arising from the base of the egg, has its origin on the side, somewhat above the base, as shown at Fig. 41*a*. No sculpturing is observable.

Newly-hatched Larva—first stage (Fig. 41*b*).—What we assume from its size to be the first stage has been sparingly found in a more or less dried-up condition upon the leaves of guava received. It is 0.41^{mm} long and 0.19^{mm} wide, regularly elliptical, flattened, and smooth. Twelve hairs of medium length protrude from each side. Antennæ short, apparently five-jointed, joints subequal. Rostrum, one-jointed, arising from a point halfway between the middle of the body and the anterior extremity. The dorsal-anal pore is distinct, and the long conical organ protrudes.

Larva—intermediate Stage (Fig. 41*d*, *g*).—A stage intermediate between the newly-hatched larva and that which seems full grown has been found and carefully studied. It is flattened, of short oval form, 1.02^{mm} long and 0.84^{mm} wide. The legs are plain, and

are short, stout, and apparently three-jointed. The basal joint is very stout, nearly as broad as long; the second joint is slender, about twice as long as broad; the third joint is very short, and bears a single stout, curved hook. The rostrum is distinct, one-jointed, and three filaments protrude. Each abdominal segment bears laterally a large, complicated pore, from which protrudes a glassy filament, short in this stage, but very long in the following. A smaller pore is situated just laterad of the base of the antenna, and those on the anal and pre-anal segments are smaller than those on the others. Antennæ six-jointed. Joint 1 short, stout; joints 2 and 3 long, subequal in length, and each five times as long as 1; joint 4 one-half as long as 2 or 3; joint 5 one-half as long as 4, sharply pointed at tip. Dorso-anal pore large, distinct; protrusile organ conical in shape, supported by a tri-lobed chitinous framework. Entire dorsal surface of body finely granulate, the ventral surface granulate laterally to the large pores. Each ventral-abdominal segment bears a transverse row of eight small secretory pores, each of which seems to be tri-cellular.

Adult Larva (Fig. 40).—Closely resembles the preceding, except that it is much more convex, and has very long glassy filaments and an abundant secretion of white wax. Abdominal segments very distinct, arched antero-dorsally, with a median longitudinal ridge. The skin of this larva splits transverso-dorsally along the hinder edge of the thorax, and from the middle of this slit medially and longitudinally to the cephalic end of the body. From this double slit the pupa presumably emerges.

Adult Female (Fig. 39*a*).—Length, 2.1^{mm}; expanse, 4.1^{mm}. Color dull honey-yellow; eyes darker; abdomen, when swollen with eggs, much lighter, and bordered with abundant waxy secretions. Antennæ 6-jointed. Basal joint short, stout; joint 2 (scape) twice as long, equal to it in width; flagellum rugoso-annulate; joint 3 longest, more than twice as long as 1 and 2 together, and equal in length to 4, 5, and 6 together. In dried specimens it becomes especially constricted at two points. Joint 4 rather more than half as long as 3; joint 5 less than half as long as 4; joint 6 equal in length to 5. Joint 6 with a bristle at tip, the other joints with sparse, short bristles. Head conical when seen from above, the rostrum plainly 2-jointed, but perhaps with a basal joint; the apical joint acute, nearly as long as the preceding joint. Eyes pyriform, large. Two ocelli, large and conspicuous. Wings large, sub-opaque, median vein divided at two-thirds wing length. Costa of fore-wing finely crenulate to tip, furnished with sparse bristles arising below edge of wing. Costa of hind wing with 8 or 9 rather long bristles or hairs near base. Legs slender, moderately long, hind tibia with an internal row of bristles, tarsi 2-jointed, two large tarsal hooks, with a median basal hook-like appendage much smaller than the lateral hooks. Abdomen with 6 plain tergites, but 5 visible urites. Sixth tergite bearing a pronounced median curved papilla; ovipositor acute.

Adult Male (Fig. 39*k*).—Resembles the female except in being more slender and longer by virtue of the two large forficular claspers, nearly as long as the entire abdomen and which give the average specimen a total length of 2.8^{mm}, as against 2.1^{mm} for the female. Between the two claspers is a short curved style rather more than one-third the length of the claspers. Sixth tergite bears a median papilla and the fourth urite a similar one. Color of abdomen much darker than in female, particularly at hind border of segments; claspers still darker.

FURTHER NOTES ON THE COTTONTAIL BOT, WITH THE BREEDING AND IDENTIFICATION OF THE FLY.

By C. H. TYLER TOWNSEND, *Kingston, Jamaica.*

In a paper in *Psyche* for August, 1892, the writer published a description of this bot. In the present paper some supplementary notes are presented on the larva of this species, followed by a description of the

adult flies bred from bots taken from cottontails in southern New Mexico.

On July 27, 1892, a young cottontail was shot near the G Bar Ranch, in the cañon of the Zuni River, Arizona. A large and nearly full-grown bot was taken from it on the dorsum at the root of the tail. After immersion in strong alcohol from that date until October 16, 1892, it was measured and found to be 26^{mm} long by 16.5^{mm} wide (6th segment).

On October 15, 1892, two cottontails were shot north of Doña Ana, N. Mex., and each one found to contain two bots. One of the cottontails was a young one. The bots in the younger rabbit were located, one in the left dorsal region and the other in the dorsal region of the spine; in the other rabbit, one in the left pectoral region and the other in the ventral region of the abdomen near the median line. Each lay in a separate cyst, which opened to the outside by a small round hole through the skin. The bots keep the anal segment inserted in this orifice, thus procuring air through the anal stigmata. Two or three of the bots seemed to be of nearly full size. After a ride horseback of about seven miles, during which time the rabbits were carried in the pocket of a hunting coat, they were taken out, and one bot was found to have escaped from each rabbit. These two escaped bots were found in the pocket of the coat. They measured, alive, from 28^{mm} to 30^{mm} or more in length and 13^{mm} to 14^{mm} in width (6th segment). As they were to all appearances nearly or quite full grown, a glass jar of earth was prepared and they were placed therein. Both bots immediately began to bury themselves in the earth and in the space of about ten minutes were entirely buried and out of sight. By placing the ear to the mouth of the jar it was distinctly evident that they were burying themselves still deeper. The earth in the jar was nearly four inches in depth, and the next morning, or about ten hours after they had begun to bury themselves, they were still heard to be moving. On the evening of this day one was found to have reached the bottom of the jar.

The other two bots, which had remained in the rabbits, were extracted and placed in alcohol. One of them was but little smaller than the above two, while the other was still smaller and of a general lighter more rufous color. The three larger bots were of a general blackish color, from the darker color of the numerous horny spined plates of the integument. The two smaller ones measured alive 27^{mm} and 22^{mm} long, by 13^{mm} and 11^{mm} wide (6th segment). It was noticed that these bots remained alive for a long time after immersion in alcohol. The lighter one was still alive and moving in the alcohol the next morning, ten hours afterward. After these two were about dead and curved into their usual position, they measured 25^{mm} and 20^{mm} long by 11^{mm} and 12^{mm} wide.

The jar of earth containing the two live bots was sunken in a wooden box of earth, and placed on the flat roof of an adobe house, where it

remained undisturbed through the winter. A piece of muslin was tied firmly over the mouth of the jar, and the latter was protected from heavy rains and snowfalls, when these occurred, by a tin lid or cover placed over it. The cover was left off during fine weather, which generally prevailed. In this manner very little moisture was allowed to reach the earth in the jar. On the 11th of May, 1893, two dead bot flies were found on the surface of the earth in the jar. They had issued sometime during the previous week or ten days, since that was the last time the jar had been examined. It was expected that they would probably issue about the first of June.

A study of these flies, which were in perfect condition, shows that they are, without doubt, *Cuterebra fontinella* Clark. This species was originally described from Illinois, where it was known to infest rabbits (see Brauer, Monogr. Œstridæ, p. 242). Since the description given by Brauer, which I take to be merely Clark's original description transcribed, is rather brief and indefinite, I present the following description of the above specimens:

Cuterebra fontinella Clk. ♀.—Length of body, 20.5^{mm} to 21^{mm}; width of abdomen, 9^{mm} to 9.5^{mm}; width of thorax, 9^{mm} or a little more; width of head, 8^{mm} to 8.25^{mm}; length of wing, 16^{mm} to 16.25^{mm}. Front about seven-sixteenths width of head at vertex, grayish black, scantily grayish hairy, with two whitish triangular markings on anterior eye margin, the lower one elongate and extended in a line nearly to base of antennæ; these leave two larger transverse glabrous shining black areas. Antennæ and arista grayish. Facial depression silvery, base with blackish lower border, the black of the latter descending in one specimen in a median line on the closely approximated and soldered facial ridges. Whole of sides of face, cheeks, oral region, in fact all of head below antennæ, covered with a yellowish white bloom and clothed with whitish hairs, the oral region especially hairy; two small black spots on cheeks, one next lower margin of eye, and the other well removed therefrom toward oral slit. Dorsum of thorax and scutellum grayish black, short, and finely black hairy. Whole under surface of thorax, with sides of thorax both above, below, and anterior to wing bases, and continued completely around edge of scutellum, thickly yellowish white hairy; three black spots on side of thorax, the upper one hairy. Abdomen black, with a bluish or purplish luster, rather thickly clothed with short and fine black hairs; inferior lateral edges with regions of grayish bloom containing blackish spots, in one specimen continued faintly on sides of abdomen in places. Restoring the color of the abdomen with chloroform shows this grayish bloom, with the circular black spots, to extend in both specimens upon sides of abdomen and dorsum of last two segments, or even in places on dorsum of second segment. Legs blackish, inferior surface with more or less of a grayish bloom, especially on femora and tibiæ. Wings, tegulæ, and alulæ fuscous or smoky, the alulæ very prominently approximated to sides of scutellum when wings are closed over abdomen.

Described from two specimens bred from larvæ taken from *Lepus artemisia* (?), the common cottontail of the lower Rio Grande region in New Mexico. A somewhat larger specimen of this species was sent to me from Colorado by Prof. Gillette. It is 22^{mm} in length, and the wing is 18^{mm}. It differs but little from the two bred specimens. The glabrous black areas on lower sides of front show more plainly, the posterior one extending back nearly to vertex. A wide frontal vitta is appar-

ent, and on each side of the shining black lower border of facial depression there is a velvet black drop-like marking, which is drawn out into a point above. The arista and antennæ are more blackish, with the third antennal joint brown. The dorsum only of segments 1 to 3 of abdomen is narrowly purplish black, the side of the abdomen and all of last segment being covered with the whitish bloom and circular purplish black spots.

Puparium.—Length, 23.5^{mm} to 25^{mm}; greatest width, 12^{mm} to 13^{mm}. Much the general form of the larva, black in color, consisting simply of the dried and very hardened larval skin, stouter in middle and posteriorly, in one specimen nearly as stout anteriorly as posteriorly, widest and thickest on sixth segment. Inferior surface almost straight from a side view, the upper surface showing a nearly perfect arc of a circle in outline. Surface roughened from the spur-like plates of the larval integument, which are in some places even spine-like.

In both cases the fly issued by the dorsum of first three segments becoming perfectly detached in a single piece or cap. This cap bears at its anterior end two prominent pale-colored short but column-like tubercles projecting from the integument, apically truncate and quite removed from each other, apparently representing the larval antennæ. Puparium lined inside with thin white silken membrane.

THE SUGAR-BEET WEB-WORM.

(*Loxostege sticticalis* L.)

In our Annual Report for 1892, just published, we devoted some space to the consideration of a new enemy to the Sugar Beet, which is also mentioned by Mr. Lawrence Bruner, on page 37 of Bulletin 30, Division of Entomology, which is also just published. It also receives brief treatment on pages 51–53 of Bulletin No. 36 of the Division of Chemistry, of this Department, and our article in the Annual Report is reprinted from advance sheets on pages 68–70 of the same bulletin. This insect, a Pyralid moth—*Loxostege sticticalis*—appeared in great numbers the third week in July in certain sugar-beet plantations in the State of Nebraska. Its larvæ partially defoliated the crop, transforming under ground in long, silken tubes. A second brood appeared a month later and there are possibly three annual generations. The best remedy

FIG. 42.—*Loxostege sticticalis:* adult, enlarged (after Riley).

consists in the use of an arsenical spray. At the time of the submittal of the Annual Report last fall we were unaware of the method of hibernation of the insect, and at that time were unable to give a good figure of the pupa. Recently, however, Mr. Walter Maxwell, the assistant in charge of the sugar-beet station of this Department at Schuy-

FIG. 43.—*Loxostege sticticalis:* *a*, eggs, natural size; *b*, eggs enlarged; *c*, cocoon; *d*, larval case; *e*, cremaster of pupa, enlarged (after Riley).

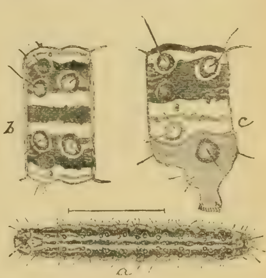


FIG. 44.—*Loxostege sticticalis:* *a*, larva, full grown, enlarged; *b*, dorsum of abdominal joint of same; *c*, same joint from side, still more enlarged (after Riley).

ler, Nebraska, has sent us a large number of over-wintered cases for the purpose of ascertaining whether the insect had successfully passed the winter and whether the outlook was favorable for a good crop of worms the coming season. At our suggestion last fall Mr. Maxwell harrowed the fields sown to beets last season, since it was supposed that this harrowing would bring the larval cases to the surface of the ground where they would be exposed to the frost and also to the attacks of insectivorous birds and mammals. He writes us May 15 that an examination showed that the cocoons which were exposed by repeated harrowings had been largely emptied by the birds—meadow larks, quail, and other species. Such as had not been rifled by the birds were chiefly dead, but occasional individuals still possessed a notable vitality. Upon ascertaining this fact he had them plowed under seven or eight inches deep and the soil compressed by rolling, considering that "their chances of seeing daylight were thus rendered extremely meager."

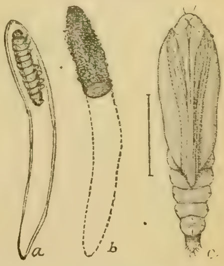


FIG. 45.—*Loxostege sticticalis:* *a*, larval case in outline; *b*, cocoon of parasite in larval case, natural size; *c*, pupa, enlarged (original).

The specimens which we received were collected November 12, 1892, and placed in a large box of earth which was placed under cover and kept through the winter, exposed to the out-of-door fluctuations of temperature, but protected from rain and snow. Examinations at this office May 16 gave the following result: Out of 141 larval cases 124 were

found to contain living insects, 72 in the larva and 52 in the pupa state. Fifteen contained dead larvæ and 2 dead pupæ. Five of the larvæ had been parasitized.

We believe, as a result of this examination, that the great majority of the larvæ left undisturbed in the field will transform to adults with success, and that in all probability the beet plantations will be abundantly stocked with eggs, probably during June; since in our estimate of three annual generations we allowed for the probable normal occurrence of a June brood of caterpillars. If we are correct in this supposition the first brood last year must have been overlooked. This may seem astonishing in view of the great numbers of the destructive brood; but two thousand larvæ scattered through a field might well escape notice, and their immediate offspring, under favorable circumstances, would number nearly a million—enough to defoliate one hundred thousand plants.

All sugar-beet growers in Nebraska and adjoining States should, therefore, watch carefully for the advent of the worms in June, and on their first appearance should apply Paris green in solution at the rate of one pound of the poison to two hundred gallons of water. If they are not found in June careful search should again be made the third week in July.

We reproduce with this note the figures which illustrated our account of the species in the Annual Report, and have added at Fig. 45 a representation of the larval case in out-line at *a*, with the larva in the lower end. At *c* we show the pupa enlarged, ventral view, while at *b* is figured an interesting parasitized specimen. The dotted line indicates the outline of the entire case, the shaded portion showing the upper section occupied by the parasite, which, at the date of receipt, was still in the larval condition, although just ready to change to pupa. It had spun about itself a compact brown silken cocoon, the end of which is exposed at the point where the dotted line begins.

The pupa of the web worm is found close to one end of the larval case, its head applied to the extremity of the case, which, however, is entirely closed with silk spun by the larva before transformation. In making its exit the moth must undoubtedly moisten and pierce the silken fibers, as is the case with other cocoon-spinning Lepidoptera.

This insect did considerable damage during the summer of 1892, but it is a species which is easily treated, and with a little care no serious trouble need be anticipated.

REPORT ON A TRIP TO NORTHWEST MISSOURI TO INVESTIGATE GRASSHOPPER INJURIES.

By HERBERT OSBORN, *Ames, Iowa.*

In accordance with instructions received October 29, 1892, I started by first train for St. Joseph, Mo., that being apparently the most available point from which to work. No definite instructions further than "northwest Missouri" were received, and the only notice I had seen of grasshopper injuries was the following, which I had clipped from the *Daily Iowa State Register* at the time it appeared:

DAMAGE BY GRASSHOPPERS.

KANSAS CITY, *October 7.*—Myriads of grasshoppers have appeared in Buchanan and adjoining counties in Kansas and are rapidly destroying the winter wheat. The hoppers are not of the variety that appeared in 1879, but the common field grasshoppers that stay in one locality the entire season. The warm weather has hatched them out by the millions, and unless cold rains or frost comes immense damage will be done. Fourteen counties in Missouri also report them.

In Buchanan county, in the vicinity of St. Joseph, I was only out a few miles from the city, but the fields examined were doubtless fairly representative for the county.

I found *Melanoplus femur-rubrum* fairly plenty in the adult stage and noticed some of the adults copulating, which would not indicate a specially early deposition of eggs. *M. atlanis* also occurred here, but in less numbers than *femur-rubrum.*

No larvæ were seen, but a few specimens of Pezotettix were taken, and the strong resemblance of these to undeveloped Melanoplus could easily lead one, on superficial examination, to think they had young *femur-rubrum. M. differentialis* was also present, but very few living specimens remained. Other species noticed were *Dissosteira carolina* and *Oncoptolophus sordidus*, both in about the ordinary abundance. Larvæ that I took to be those of *Tragocephala viridis* and *T. infuscata* were quite plentiful, and it seems to me quite possible that larvæ of these species which hatch normally in late summer may, if seen in numbers, have been supposed to be the young of the more common species and given rise to the reports of the premature hatching of grasshopper eggs. These, if hatching at the usual time, would have been only large enough three or four weeks ago to be recognized as newly hatched grasshoppers. I could find no newly-hatched Melanoplus, not any signs of dead individuals, nor any indications of eggs hatching, and, though I had not facilities for extensive diggings, I could not discover any unusual number of eggs deposited.

Upon inquiry I was informed that no damage to winter wheat was known in the vicinity, but that some had been reported near Savannah in the next county north.

At Savannah I talked with several farmers from the surrounding country and made a circuit of several miles to the west, north, and east of the town to examine the fields.

A farmer who had recently been in Holt county said there had been some little damage a few weeks ago from grasshoppers working into the edge of the winter wheat, sometimes a strip a rod wide being injured; but the wheat had been retarded by dry weather more than by grasshoppers. No grasshoppers were there now, and there had been, he said, no young grasshoppers observed during the fall. None of the parties talked with had known of any damage to amount to anything. Some stated that grasshoppers were quite plenty in pastures and meadows a few weeks before and, with dry weather, had shortened the pasturage. I found in the fields practically the same conditions as in Buchanan county. Nearly all of the species noted there were observed. In one field of winter wheat I could see along the edges that the tips of the leaves had been eaten off some time before, probably when but little above the ground, but the wheat had evidently fully recovered from whatever check may have been caused by the clipping.

I was told that some damage had been reported in Nodaway county, and though it seemed probable that the conditions would prove the same there I thought best to stop there long enough to make sure of the situation. While en route for that county I talked with a man who owned a farm at Cawood, in Andrews county, who informed me that grasshoppers had been more than usually plentiful in his pastures some weeks before, but no young ones were seen. At Guilford the same story was repeated and hasty examination showed conditions to be the same as at preceding places. The fields of winter wheat seen from the cars in passing showed no damage, though some were quite uniformly thin, or the growth short.

At Conception I was told that grasshoppers had been very plentiful and had at one time done some injury to winter wheat adjoining grasslands, but they all disappeared some time ago. Only winged ones had been seen and my informant identified them as *femur-rubrum*, some specimens of which I caught and showed him. *M. differentialis*, which I also showed him, he said was not more common than usual, but he thought the red-legged one much more abundant than usual. I found both these species and *atlanis* common and observed numbers of dead ones in the grass along the roadside or in the grass and rubbish under fences. Here I found a single specimen of a rather young larva apparently *femur-rubrum* or *atlanis*, but nothing further to indicate any fall hatching of eggs.

Larvæ of Tragocephala here, as elsewhere, were rather common. Dissosteira was also present.

In addition to the territory visited I learned from a man in St. Joseph who lives in Clay county that grasshoppers injured clover and grass there, but no young ones were noticed, which evidently indicates the

same state of affairs as in the places examined, which really agree with the conditions in general for the northern Mississippi Valley this fall. As my examinations covered a strip about fifty miles in extent in Buchanan, Andrews, and Nodaway counties, running north and south directly through the region reported as suffering from the grasshoppers, it is probable that it represents fairly the conditions through all that region.

Evidently the common species, and especially *M. femur-rubrum*, and probably with it *atlanis*, have been more abundant than usual, pastures and meadows have suffered, and in some instances winter wheat has been attacked, but clearly with only a temporary check to its growth. There is no reason from my observations to think that eggs have hatched prematurely, certainly not in any large numbers, and, as it is probable that eggs have been laid in considerable numbers, favorable conditions for their development will probably show a plentiful supply of young grasshoppers the coming spring.

Where young hoppers were actually observed it seems quite probable that they were young of Tragocephala or some of the hibernating species.

Some statements made, and especially at Conception, lead me to suspect that *atlanis* might have been rather common and that some flights may have occurred, but I could get no positive data regarding this point.

THE ANGOUMOIS GRAIN MOTH OR "FLY WEEVIL."

(*Gelechia cerealella.*)

By L. O. Howard.*

The State of Virginia seems to be the original American home of this destructive grain pest. Originally, without doubt, a European insect, it was unquestionably imported by the early settlers of Virginia in their supplies of wheat brought from the old country. From this center it has spread in all directions through the country, but more extensively and injuriously towards the south than towards the north, since it does not thrive in a very cold climate. South of the wheat belt it is a very serious enemy to corn, reaching its maximum as a corn pest in Texas. In the extreme northern States it is frequently found in grain which is stored, for one purpose or another, in buildings which are artificially warmed, but although frequently carried north during the summer in grain, it dies out in course of time in cold storehouses or mills. It affects not only corn and wheat, but all other stored cereal products.

---

*Read before the Farmers' Institute of the Eighth Congressional district of Virginia, February 23, 1893.

The best of the early writings upon this subject are by Virginians. At the beginning of the present century it was investigated by Mr. Landon Carter, and later Mr. Edmund Ruffin, a well-known writer upon agricultural topics, and the man who first suggested the value of marl as a fertilizer, paid some attention to this pest, and wrote several very able articles upon its habits and the best measures to be taken against it. Since the war the literature upon this insect has been devoted to a consideration of its habits as a corn pest in the south, and only recently have its injuries to the wheat crop of Virginia and Maryland become so serious as to attract general attention. Prof. Riley published a general article upon the species in his report as Entomologist of the Department of Agriculture for 1884, and within the last year Prof. E. W. Doran, late Entomologist of the Maryland Agricultural Experiment Station, published a good account of the insect upon pages 437–441 of Bulletin 16 of the Station.

The farmers of Virginia are particularly concerned with the damage done by this insect to the wheat crop. Its habits need not to be dilated upon, since they are doubtless familiar to all concerned in its treatment. It may be stated briefly, however, that the parent insect is a small gray moth or "candle fly," resembling a clothes moth. This moth lays its eggs only upon hard grain. The eggs hatch into small, whitish, maggot-like caterpillars, which eat out the interior of the individual grains, and when full grown spin delicate silk cocoons from which the moths eventually issue. The insect passes the winter only in your barns and storehouses. It will breed uninterruptedly, generation after generation, in stored wheat. After the time of harvest the moth flies out from the granaries to the wheat fields and will lay its eggs upon grains of wheat in the shocks. The larvæ are not destroyed in the threshing and are carried back to the granaries again. From these facts it is plain that if the granaries of a neighborhood are kept free from the insect the shocks will not become infested in the fields. If an individual farmer, however, takes the trouble to disinfect his granary, his wheat shocks will be infested by moths flying from the barns of his neighbors, provided he does not thresh very soon after harvest. In such cases early threshing is very important. I realize the difficulty which frequently occurs in getting the thresher at the proper time, and where the wheat must be left in the field the individual farmer must disinfect his granary every year soon after the wheat is put in. There is an alternative, however, and it is a most desirable alternative, and upon its practice depends the diminution of the insect in numbers, if not its practical extermination, in any given neighborhood. Let all of the wheat growers of a neighborhood by concerted action disinfect their granaries thoroughly for one or two years. It is plain that if this be done all future damage will depend upon the importation of the insect in cereal products from some other locality. This is a plan which it is eminently fitting that a body of farmers like this should take into ear-

nest consideration, provided the amount of damage annually done by this pest would seem to warrant the trouble and expense.

How is the disinfecting to be done? A mal-odorous, inflammable liquid, known as bisulphide of carbon, is the agent, and its application is very simple. The simplicity of the operation depends upon the fact that the liquid is extremely volatile. When exposed to the air it evaporates with great rapidity, and its vapor is sure death to insect life. Prof. Doran, in the bulletin of the Maryland Agricultural Experiment Station above referred to, following earlier writers, recommends the use of this substance in tight bins, and when so used it is undoubtedly more effective, but there is no absolute necessity for a very tight receptacle, and it may be used to advantage in a reasonably close room of any dimensions. The method is to pour the liquid into shallow vessels, like small tin pans, and set them on top of the grain. The vapor is heavier than air, and will sink down through the mass of grain and destroy all insects. The amount to be used varies with the space to be treated. When used in bins, a pound and a half to a ton of grain is recommended by Prof. Riley. When used in a reasonably close room or in a nearly empty bin, one pound of the bisulphide should be evaporated for every one thousand feet of cubic space, or in a space 10 by 10 by 10 feet, $\frac{1}{3}$ of a pound in each of three shallow vessels for a space of these dimensions. For a space 10 by 10 by 20 feet, use 2 pounds in 6 vessels; for a room 10 by 20 by 20 feet, use 4 pounds in 12 vessels, and so on. Make the room as tight as is convenient. A good time to treat the grain is on Saturday afternoon. Place your pans of bisulphide in position, close the room up tightly before dark, and leave it closed until Monday morning. Then air the room thoroughly, and stir the grain to some extent. The vitality of the grain will not be injured in the least, nor will its edible qualities be harmed.

One point should be always borne in mind in using bisulphide of carbon, and that is its extreme inflammability; its vapor when confined is even explosive. No light nor fire should be brought into its vicinity. With care in this respect, however, it is easy and safe to handle, and it is not dangerous for a human being to inhale a reasonable amount of the vapor, in spite of its extremely offensive odor—to which, by the way, one soon becomes accustomed.

There is no need to insist before this Institute upon the value of concert of action in many farm operations, but in no way can the results of concert of action be made of more practical benefit than in the warfare against injurious insects. In regard to this specific pest I feel certain that following the plan outlined will result in the almost complete annihilation of the loss which it annually occasions.

It may be of interest to repeat here the excellent recommendations made by Mr. Ruffin against this insect as a wheat pest. He says:

Wheat, as soon as reaped, and perhaps sooner, is supplied from the granaries with a greater or less number of parent weevils to lay the earliest brood, and if it remains

in the straw until September, and when thrashed is left in small bulk, or often stirred, nearly all the grains may be weevil-eaten; but if wheat be thrashed and well fanned early in July, in this region, there will be no weevils worthy of notice. The eggs previously laid probably do not exist on the grains, but on the chaff or shuck in which they are inclosed, and, in hatching, the maggots must perish for want of food. As is the case with corn, the bulk of clean wheat is not exposed to subsequent layings, except on the grains at the surface of the bulk. Even if the eggs had previously been attached to and had remained with the grains instead of the chaff, as I infer to be the case, and then hatched in the interior of the bulk, the weevils could not escape from such close confinement, but would die without increase.

Seed wheat is usually kept spread out at least ten inches thick, in order to avoid any possible heating from remaining moisture, and by some farmers is frequently stirred, both of which conditions offer a greater opportunity for the depredations of these insects. Notwithstanding this, it is rare that they become numerous.

The bulking of early thrashed wheat without separating the chaff is also said to be sufficient protection from the weevil. Of this mode I have no experience. Its efficacy must depend, not on the removal of the eggs, but on the stifling of the maggots, and the inability of either the maggots or the moths to move in so close a mass.

Against this insect as a corn pest the practice is being generally adopted in some sections of the south, largely upon the recommendations of the Division of Entomology, Department of Agriculture, of growing only such varieties of corn as have a close-fitting husk, thus preventing the insects from laying their eggs upon the corn in the field, and of storing the corn in cribs without removing the husk. The damage done by the weevil is thus reduced to a minimum, although the storage space required is greatly increased.

It may be well to add that the bisulphide of carbon treatment above outlined is efficacious not only against the so-called Fly Weevil, or Angoumois Grain Moth, as it is sometimes called, but against all other insects which affect stored grain, and of these we have some five or six species in this country, all beetles in the parent stage. I may also add that this capital remedy was first suggested by Dr. C. V. Riley, in the columns of the *Farmers' Review* of Chicago, in March, 1879.

In the purchase of bisulphide of carbon, co-operation can be used to great advantage. It can be bought from wholesale chemists in 50-pound cans for 15 cents per pound. At retail it costs from 25 to 35 cents per pound. It is perhaps unnecessary to state that when not in use it should be kept in tightly closed receptacles, in which there is as little air-space as possible.

DESCRIPTIONS OF NOCTUIDÆ FROM THE DEATH VALLEY.

By Prof. J. B. SMITH, *New Brunswick, N. J.*

PERIDROMA DEMUTABILIS, n. sp. (Fig. 46, 1).—Ground color grayish white, with a more or less obvious luteous powdering. Head immaculate. Collar with a variously distinct luteous or smoky median line. Disc of thorax white, luteous or smoky. Patagiæ with luteous or smoky margins. Primaries strigate, the dark shadings luteous or smoky, the median line wanting. There is a basal black streak, above which the base is white and below which it is quite dusky; to this

streak is attached the long claviform, which extends beyond the middle of the wing, is somewhat paler in color, and defined by a very narrow black line which is usually incomplete. The ordinary spots are confluent, together irregularly gourd-shaped, inferiorly well defined by dark shadings, superiorly indefinite; the orbicular is paler than the ground, with a faint yellow tinge; the reniform is dusky centered. The s. t. line is marked by a smoky or blackish shade, interrupted below the apex, which may be either even and continuous, or invade and darken the terminal space, or may send in a spur over vein 5 to the lower edge of the reniform, joining the dusky shading beneath that spot. A very narrow dusky terminal line; the fringes white. Secondaries white, immaculate. Beneath white, the primaries with a dusky shading in the disk.

Expands 27–31^{mm}; 1.10–1.24 inches.

Habitat.—Granite Springs, San Bernardino County, California, April 6.

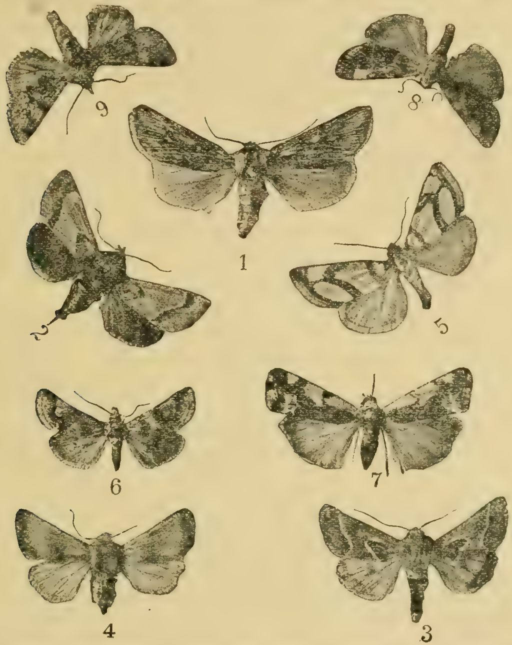


FIG. 46.—1, Peridroma demutabilis; 2, Schinia ligeæ; 3, Schinia intrabilis; 4, Omia nesæa; 5, Antaplaga koebelei; 6, Tristyla alboplagiata; 7, Acontia lanceolata; 8, Acontia (?) n. sp.; 9, Oncocnemis flagrantis.

Three specimens, 1 male, 2 females, are before me, no two exactly alike, and yet resembling each other closely. The species is unlike any other which has been referred to *Peridroma*, in the color and in the strigate character of its markings; but it agrees with the structural characters of the genus and has the pointed wings of the *saucia* group. The antennæ of the male have the joints slightly marked and ciliated. The tibial armature on all legs is feeble, and that of the anterior pair is scarcely more developed.

SCOTOGRAMMA DENSA, n. sp.—Ground color a sordid luteous gray, with fuscous powderings varying in density. Head and thorax immaculate save that there is

sometimes a paler central shade on the disk of the thorax. Primaries with all the ordinary maculation obscured by the dark powderings, and yet all of it traceable. Basal line geminate, wanting in dark specimens, fairly defined in the others. T. a. line geminate, the inner line vague, the outer outcurved between the veins, as a whole upright or very slightly oblique. T. p. line geminate, the inner line most evident, feebly crenulated, outcurved over the cell, and rather evenly oblique below. S. t. line a pale irregular shading near the outer margin, variably distinct in the specimens before me, and in one case well defined by a darker preceding shade. A series of dark interspaceal terminal lunules, followed by a pale line at the base of the fringes, the termination of the veins somewhat emphasized by the same color. There is an indication of a vague median shade line, most marked between the ordinary spots, where it darkens the cell. Claviform faintly indicated in some, wanting in other specimens. Orbicular round, concolorous, very feebly marked in most instances. Reniform moderate in size, upright, kidney shaped, sometimes defined by a narrow black line, sometimes only by a vague dusky shading, usually a little darker centered. Secondaries soiled whitish at base, smoky outwardly, with a fairly marked dark line at the base of the pale fringes, and a variably evident, never well-marked discal lunule. Beneath whitish, variably powdered with dark scales, forming a discal lunule on one or both wings, and sometimes an outer band as well.

Expands 26–30^{mm}; 1.05–1.20 inches.

Habitat.—Argus Mountains, April, 1891.

Four specimens, three of them males, are under consideration, and others not differing are in the National Museum. While all the specimens look very much alike in general appearance, no two agree in ground color nor in the distinctness of the maculation. It is one of those obscurely marked forms characteristic of the genus to which I have referred it, and which it is exceedingly difficult to characterize satisfactorily. It differs from the congeneric forms by the powdery luteous ground color and the fragmentary and obscure maculation.

ONCOCNEMIS FLAGRANTIS, n. sp. (Fig. 46, 9).—Ground color a peculiar rusty luteous, varying in shade. Head and collar immaculate. Thoracic disk with gray and black scales intermixed, the patagia margined with the same mixture. Primaries with the markings sordid black, the median space densely powdered with black scales, through which the ground color appears at irregular intervals. Basal line diffuse, single. T. a. line vaguely defined, geminate, the inner line consisting of irregularly disposed black scales, the outer indicated only by the dark median space as a whole. T. p. line defined by a series of irregular spots of the ground color to the submedian vein, up to which point the dark shading extends to the s. t. line; below this the contrast between median and sub-terminal spaces indicates the line. S. t. line irregular, marked by the difference between the s. t. and terminal spaces to the sub-median vein, below which it is obsolete to the inner margin where it is again indicated by a few black scales. A series of dark, interspaceal terminal dots, beyond which the fringes are cut by a dusky line. The fringes are long, of the ground color, with a dusky interline, and cut as above described in the interspaces. The claviform is traceable, centered with the ground color, margined by a somewhat more compact massing of darker scales. Orbicular small, round, distinct, of the ground color, with a dark central dot. Reniform large, of the ground color, indefined and sometimes black powdered. Secondaries a sordid yellowish white, the veins and an indeterminate outer band smoky or blackish. Beneath dull yellowish, powdered, sometimes with the disk of primaries darker, and on secondaries with an obscure punctiform outer line.

Expands 23–26^{mm}; 0.92–1.04 inches.

Habitat.—Argus Mountains, April, 1891.

Five specimens are under examination. The species belong to the *homogena* series and is perhaps nearest to *glennyi*, than which it is considerably smaller, differing also in color. It is not unlike a *Perigea* allied to *pulverulenta* at first sight, and except for the structural characters it would most naturally be referred there.

SCHINIA LIGEÆ, n. sp. (Fig. 46, 2).—Ground color a bright, though pale luteous, in some cases with an admixture of brown. Head and thorax immaculate, abdomen more smoky. Primaries with the median space white, or whitish with a yellowish tinge, else of the ground color. The darkest shades are those preceding the t. a., and following the t. p. lines, and these lines are marked only by the color contrasts between the spaces. T. a. line outwardly angulate, forming nearly a right angle. T. a. line very evenly and equally bisinuate. S. t. line faintly traceable in some specimens as an irregular white shade, but usually obsolete. Ordinary spots obsolete in most of the specimens, the reniform indicated in others. There is a series of terminal dots which is evident in most specimens. Secondaries smoky to blackish. Beneath, primaries smoky, the margins whitish, secondaries white.

Expands 23–28^{mm}; 0.92–1.12 inches.

Habitat.—Argus Mountains, April, 1891.

Eight specimens are before me, and others not differing in appearance are in the National Museum. The anterior tibiæ are furnished with one inner and one outer short, stout claw at tip, and the nearest structural ally is *S. spinosæ*. There is a considerable variation in size; but otherwise the specimens are very much alike and very simply marked.

SCHINIA INTRABILIS, n. sp. (Fig. 46, 3).—Ground color pale luteous, with an olivaceous shading in the darker parts of the wings. Head and thorax immaculate, the abdomen somewhat paler. Primaries with the median lines whitish, broad, the median space paler than the other parts of the wing, and with white powderings, which are most evident along the costa. The t. a. line starts from the base below the median vein, extends along it about half way to the end of the cell, makes an abrupt curve and thence runs inwardly oblique, to the hind margin; the pale median shade therefore extends above the median vein to the base of the wing. T. p. line from the costa a little before the apex, rigid to vein 5, then with a gentle incurve, reaching the hind margin a little before the anal angle. S. t. line broad, pale, straight, followed in some specimens by vague venular points. The reniform is indicated by a blackish shade, visible from the underside through the wing. Secondaries white with a yellowish tint, with a large black discal lunule, and a blackish outer border which is interrupted at the middle of the margin by a pale shade. Beneath whitish; primaries with a very large, prominent discal spot and sometimes an incomplete submarginal line; secondaries immaculate or with a discal spot, sometimes also with traces of an outer line.

Expands 23–24^{mm}; 0.92–0.96 inch.

Habitat.—Death Valley, April, 1891.

Three specimens, representing both sexes, are before me. Fortunately one of them boasts of one fore tibia, on which are 2 inner and 4 outer claws, the 4th shorter than the others, and the species is thus related to the eastern *S. rivulosa*, albeit quite different in color. The species should be easily recognized from the course of the t. a. line which does not cross the wing, but bends back abruptly and runs to the base before crossing the median vein from below. The t. p. line is also abnormal

in course, making it start close to the apex instead of about the middle or outer third of the costa. At first sight the species look like *separata*, but the tibial armature, and indeed the maculation also, when carefully studied, prove it to belong elsewhere.

TRISTYLA, n. gen.—Head distinct; eyes large, rather prominent, globose, naked; tongue well developed; palpi well developed, closely scaled, oblique, extending to or a little beyond the tip of the central frontal process; front produced into a flat plate which forms two short basal teeth to a long, pointed, central process exceeding the head by its own length. The thorax is moderate, the vestiture scaly, close, except that it forms a truncate, round, basal tuft. Abdomen somewhat exceeding the hind angles of the secondaries, rather slender and closely scaled, untufted. Legs moderately long, slender, with close scaly vestiture; tibiæ unarmed except for the usual spurs on the middle and hind pairs. Wings moderate, rather broad for their length; primaries with the costa nearly straight, apex produced, acute, outer margin very oblique, convex; venation apparently normal, the accessory cell present; secondaries proportionate, the margins rounded, vein 5 as strong as the others.

This genus belongs to the Acontiid series rather than to the Heliothids, and its most distinctive character is the peculiar frontal structure. I recollect no other Noctuid with a similar pronged process.

TRISTYLA ALBOPLAGIATA, n. sp. (Fig. 46, 6).—Ground color white. Head with a very narrow black line at base; patagia with black scales toward their tip; dorsum of thorax luteous, posterior tuft white. Primaries with a narrow black basal line, extending only to the subcostal vein. T. a. line geminate, the outer line black, nearly upright, making three slight outcurves; inner line grayish, shading off into a mixture of gray and yellow scales which extends half way to the base. T. p. line single, black, interrupted, irregularly lunulate, with a deep incurve below the cell. The outer part of the median space is luteous gray except for a large, quadrate, white costal patch, and this dusky shade extends to the s. t. line, which is narrow and irregular, defined primarily by the contrast between the s. t. and the white terminal spaces. Apex grayish luteous. A broken dusky terminal line. Fringes white. The claviform is wanting. Orbicular indicated by a few black scales. Reniform marked by a large, quadrate, white blotch, which extends from the costa to the median vein, beneath which it is black margined, and from the middle or near it, to the outer fourth of the costal margin. Secondaries smoky, immaculate. Beneath, primaries blackish with narrow whitish margins; secondaries white with an extra median line and discal spot.

Expands 18–20mm; 0.72–0.80 inch.

Habitat.—Argus Mountains, April, 1891.

I have three specimens, representing both sexes. This is a very pretty insect and easily recognizable, not by its structural characters alone, but by its markings as well. The base is white, limited by the grayish luteous band extending to the t. a. line; a broad band of white follows, and beyond this the dark color obtains to the s. t. line, except for the large white costal patch which occupies the outer part of the median space above the incurve of the t. p. line. The wing form and habitus is not at all unlike *Antaplaga* at first sight, while the truncate thoracic tuft and the close scaly vestiture implies *Acontia.*

OMIA NESÆA, n. sp. (Fig. 46, 4).—Ground color very pale whitish green. Head and thorax immaculate. Primaries immaculate, save that there is an oblique, broad, diffuse, darker green median fascia, and a deeper tinge of the same color at the

outer margin. In some specimens a pale t. p. line is visible, and in one case the reniform is indicated. Secondaries white, with a yellowish tinge, immaculate.

Expands 21–24^{mm}; 0.84–0.96 inch.

Habitat.—Argus Mountains, April, 1891 (Death Valley Exp.); Western Utah, Weidt.

I have seen 8 specimens, of which the one collected by Mr. Weidt is in the Neumoegen collection, the others from the U. S. National Museum. The species is so nearly immaculate that it is easy to describe it. There is, perhaps, a question as to the correctness of the generic reference, but the species agrees fairly well with the description of the genus, and has the shape, though not the color, of the European forms. The eyes are small, naked, round, and hardly retracted, though not prominent; the palpi are moderate, reaching to the middle of the front; terminal joint obtuse. Front with a prominent, navel-shaped protuberance. Thoracic vestiture hairy, loose, hardly divergent, forming no tufts. Primaries short, the costal margin somewhat depressed, the apex a little acute, outer margin oblique, a little convex, the fringes long. The legs are short and stout, clothed with rather long and fine vestiture, tibiæ not spinose, the anterior unarmed at tip.

PLEONECTYPTERA FINITIMA, n. sp.—Ground color varies from gray to fawn brown. Head and thorax immaculate. Basal line wanting. Median lines marked at their inception on the costa by black triangular spots; t. a. line upright, even, consisting of a brown outer and a yellowish inner shading, the latter sometimes wanting, and the entire line sometimes reduced to a few dark scales; t. p. line yellowish, with a narrow, dark brown inner shading, which is sometimes wanting and sometimes punctiform; as a whole the line is evenly and not strongly bisinuate and only a little oblique inwardly. S. t. line irregular, very slightly paler, almost obsolete in some cases, preceded by dots or distinct blackish shades in others. Claviform and orbicular wanting. Reniform of good size, kidney shaped, black in most of the specimens, in one case almost obsolete. Secondaries soiled luteous, with a reddish-brown tinge, which intensifies outwardly. Beneath, reddish brown, powdery, the primaries with a discal lunule more or less evident, and occasionally the markings of the upper side faintly reproduced; the secondaries sometimes have an outer line and discal spot, but are as often immaculate.

Expands 22–23^{mm}; 0.88–0.92 inch.

Habitat.—Argus Mountains, April, 1891; Los Angeles, Cal., in October.

Four specimens are before me, but I have seen a number of others. Three of them are from the Argus Mountains. The species of *Pleonectyptera* are extremely variable in many cases, and this species is no exception. I would not be much surprised if forms entirely immaculate occurred. There are several undescribed species referable to this genus, and I would not have named this at present were it not desirable to make the list of species taken as complete as possible.

ANTAPLAGA KOEBELEI Riley, n. sp.*(Fig. 46, 5).—Average expanse 22–25^{mm}. Ground color, silvery-white; markings ochraceous. Head with the ocherous scales predominating; frontal depression with a central conic elevation which extends well beyond the rim. Thorax with a broad ochraceous median band on the collar; brown behind the collar, and with a brown discal line extending to the base; patagium margined with ocherous: Primaries with the silvery-white broken only by the ordi-

---

* This species is described by me in this connection, because it was included in Mr. Smith's photograph.—C. V. R.

nary lines, which are as follows: From an ocherous spot at base, representing the half line, a band extends along the costa to the broad, even, upright t. a. line: The t. p. line is geminate, making it appear twice as broad as the t. a. line, the intervening space between the double line being yellowish; it is broad at costa and bent posteriorly, forming an acute but rounded angle beyond the cell, and a trifle incurved along its inner bend; a line extends from the elbow to the s. t. line, which runs very close to the outer margin, starting from the costa a little before the apex and gradually nearing the margin until upon the submedian vein it sometimes becomes coincident with it: there is also a narrow terminal line, and the space between it and the subterminal is also yellowish: fringes at the apex, with an ocherous interline: reniform spot indicated by a small blackish dot. Secondaries yellowish-white, glistening. Beneath, primaries smoky, with narrow white margins: secondaries white. Abdomen white, with a yellowish tinge.

Habitat.—Argus Mountains. Taken April, 1891, by Mr. Koebele.

Described from three specimens. The species is most nearly related to *dimidiata* in body structure and wing form, but quite different in ornamentation.

THE RED-LEGGED FLEA-BEETLE.

(*Crepidodera rufipes* L.)

ITS INJURY TO ORCHARD TREES IN MARYLAND AND VIRGINIA.

On April 11 of the present year the Secretary of Agriculture referred to the Division the following letter:

COLEMAN'S FALLS, VA., *April 9, 1893*.

SIR: I have had over 1,000 peach, pear, and plum trees entirely denuded of all blossoms and buds, both active and dormant, in less than forty-eight hours by a flea-beetle whose attack I have not been able to arrest up to the present writing. If you can send an agent to study habits and remedies in the interest of horticulture I will extend hospitality, force-pumps, labor, etc., necessary to his purpose.

Respectfully,

GEO. E. MURRELL.

No specimens accompanied this communication, but the insect attack therein described appeared to be of sufficient importance to call for further investigation. We therefore instructed Mr. E. A. Schwarz to proceed as soon as practicable to Mr. Murrell's place to learn all he could about the injury. This he has done and we append his report.

REPORT OF E. A. SCHWARZ.

Mr. Murrell's farm at Coleman's Falls is situated at the base of a high spur of the Blue Ridge Mountains. The numerous narrow valleys in this section of the country are separated from each other by rather flat-topped ridges, which are usually covered with a magnificent growth of chestnut trees. Black locust trees (*Robinia pseudacacia*) are very rarely met with in the chestnut forest on these ridges, though they are common to the valleys along the roads and fields as well as on the edge of the forest. If, however, the chestnut trees on the ridge be cut down, they are speedily succeeded by a dense growth of shrubbery mostly composed of Robinias.

The insect invasion presently to be described took place on the top of one of these ridges which years ago had been cleared, and where for a number of years oats and other field crops had been cultivated. Six years ago this cultivation had been abandoned, and the clearing was overrun with locust bushes. In the month of March, of the present year, Mr. Murrell had this shrubbery grubbed up, plowed the

land, and set out nearly one thousand young orchard trees, most of them being peach trees. This was towards the end of March, and in the first week of April, during the first warm days of the year, immense numbers of a small Flea-beetle, which proved to be *Crepidodera rufipes,* appeared on the young trees on which the first buds were just pushing out.

Long before the time of my visit (April 14) the beetles had done as much damage to the trees as can possibly be done by a phytophagous insect. Not a single green leaf or living bud was to be seen on the newly-planted trees. Yet the beetles were still very numerous on the trees, and this in spite of several applications of insecticides made by Mr. Murrell from April 8 to April 14. On one tree, which had not been recently treated with insecticides, I counted 52 beetles. Most other trees harbored a much smaller number of specimens, averaging about 15. The presence of the beetles at this time was at first glance difficult to account for, since there was apparently nothing left on the trees for the beetles to feed upon. Examination showed that those buds which at the time of the invasion were most advanced were attacked at the tip, and the beetles eat or burrowed their way through the center of the bud through its very base within the stem. The outer folds of leaves of such buds were left intact, quickly died and dried up, while within the buds almost always one or more beetles could be found with their heads deeply buried in the base of the bud in order to feed upon the exuding sap. The younger buds were devoured bodily and the beetles then crowded around the base to lick up the sap. Other beetles, for which there was no room on such places, were wandering up and down the trees in search of buds hitherto overlooked, many copulating pairs being seen among them. Other beetles driven by hunger were also seen eating the bark of the tips of the trees. In a few instances some of the older leaf buds had opened before the attack of the beetles commenced, but there was no crowding of beetles on the young leaf, though occasionally one or more of those oblong holes on the surface of the leaf, so characteristic of the feeding habit of Halticids, could be found. It was plainly to be seen that it was not so much the leaf substance as the sap of the trees the beetles were so eager to get at.

As a matter of course the damage done to the young trees must be very severe, and this the more so because the beetles do not give the trees the slightest chance to recuperate. My impression was that should the beetles remain in force on the trees for a week longer the trees would necessarily be killed.

Several choice varieties of peach trees are planted in this orchard, but all of them appeared to be equally subject to the attacks of the beetles. Some pear trees, however, had suffered less. Here only the tips of the young buds had been eaten, so that at least a few, though mutilated, leaves had made their appearance.

Another orchard, not far distant from that just described, and situated on the slope of the same ridge, presented a little more varied conditions. Here the lowest and most sheltered portion of the old clearing was plowed three years ago and planted with peach trees. Two years ago another portion of the clearing, higher up the slope of the hill, was added to the orchard, and then Mr. Murrell noticed first the appearance of the beetles. But this invasion, which took place also very early in the spring, was less severe than that of the present year, when the highest part of the clearing was plowed and set out with peach trees. The beetles attacked and injured the newly set trees as well as the two-year old trees in the same way as on the first-mentioned orchard; but the three-year old trees suffered much less. It appears that at the time of the appearance of the beetles the buds of these trees were considerably more advanced than those of the younger trees; they unfolded faster than the beetles could destroy them. Thus the trees were at the time of my visit in full foliage, although many beetles were upon them riddling the leaves with small holes.

As to other food-plants of the beetle, there was no chance of making any observation on the parts of the orchards just laid out, since besides the fruit trees there was not a single plant on the newly-plowed ground. The surrounding forest still presented a very wintery appearance, and not a single specimen of the beetle could

be found on the buds of the various trees and low plants. Along the edge of the forest, however, a few beetles could be seen on the buds of a dogwood (probably *Cornus florida*), and the buds themselves showed evidence of injury. On the older portions of the second orchard some beetles were found eating the young leaves of a blackberry (Rubus), and a solitary young shoot of a locust tree harbored many specimens. The leaves of a few wild cherry trees showed signs of injury, but the originator proved to be *Apion nigrum*. In the valleys where the vegetation was more advanced than on the ridges no beetles could be found except on the young shoots of black locust.

From analogy with the habits of other species of Crepidodera,* as well as from the ravenous appetite of the beetles, their sudden appearance in great numbers, and from their dark color,† it is safe to assert that they had hibernated in the imago state, and efforts were made accordingly to ascertain the place of hibernation. The insect sieve was brought into requisition, and after some failures I succeeded in finding a few specimens under a heap of old leaves and rubbish at the edge of the forest and close to the newly-plowed orchard. No specimens were found in the depths of the woods, although I chose for investigation places which from experience I knew to be favorable as hibernating quarters of insects, and where, indeed, many other Coleoptera (notably *Typophorus canellus*) and Hemiptera were found by me. However, on the surface of the ground of the newly-planted orchard many beetles were seen crawling about, and many others were found under the clods of earth or within the loose soil, so that I was forced to the conclusion that the place of hibernation and the starting point of the invasion was the newly-made orchard itself, which, as stated above, had been covered with a growth of locust bushes up to March of the present year. It is to be regretted that no absolute certainty could be obtained regarding this point, for it has evidently an important bearing upon the means of avoiding future injury, as will presently be explained.

It may safely be asserted that the peach and other orchard trees are not the original food plants of the imago or larva of this Crepidodera. The consensus of all field Coleopterists in America is that the black locust (*Robinia pseudacacia*) is the favorite food-plant of the imago.†† But the beetles are also found on various other plants, and in my experience it is near Washington not rare on beech, the leaves of which it riddles with holes. I have never seen it feeding on any herbaceous plants. The true food-plant of the species *i. e.*, the food-plant of the larva, still remains unknown, but it is safe to say that if the larva were feeding openly on the leaves of some plant, or if it were a leaf-miner, it would have been discovered long ago, either in Europe or here. It appears to be almost certain that the larva of this as well as other species of Crepidodera and of the closely-allied genus Epitrix are root-feeders, and it is but natural to assume that the larva of *C. rufipes* is to be found within or at the roots of that plant, which is the favorite food-plant of the imago. Although I did not expect to find the larva of the Crepidodera at this season when the insect was in the imago state, I carefully exhumed and examined a clump of young locust shoots which grew between the three-year old peach trees of the second orchard, but neither the roots nor the rootlets showed the slightest sign of having been attacked by any insect larva. This is of course no convincing proof that the larva does not live on locust roots. Since no other wild leguminous plants were seen thus early in the season in the orchards or within the woods any further attempts to find evidence of the larva had to be abandoned.

Mr. Murrell first noticed the beetles on the orchard trees on April 7, and at once set to work to kill the invaders. Pure pyrethrum powder was first dusted over all

* Our common species of this genus, viz, *C. helxines*, *C. modeeri*, and *C. atriventris*, are well known to hibernate in the imago state.

† Of the many thousands of specimens seen by me, none had that bright-red color on head and thorax as seen in specimens found in summer time.

†† There are only two published records of this fact, viz, by Mr. Wm. Beutenmüller (Ent. Amer. VI, p. 177) and by Mr. F. H. Chittenden (Proc. Ent. Soc. Wash., II, p. 206).

trees of both orchards and the application repeated the next day. From Mr. Murrell's observations it would appear that a great number of the beetles were killed (or perhaps only temporarily disabled?) thereby, but at any rate there was no diminution of the invasion. Then Mr. Murrell sprayed the trees of the first orchard with London purple water (2 oz. to 40 gallons of water) and repeated the spraying the next day, using a Nixon spray machine and a Japy knapsack sprayer which had been furnished by the Virginia Agricultural Experiment Station. Mr. Murrell was not certain whether or not any beetles were killed by this spraying; at any rate, the evil did not abate. On April 14 Mr. Murrell changed his tactics and commenced spraying with kerosene emulsion. The emulsion (milk and kerosene) was correctly and successfully made, diluted four times its volume with water, and applied to the trees by means of the Nixon pump, three men being necessary to carry on the operation. I witnessed myself the spraying, which was a very thorough one, and which progressed at a rapid rate where the ground was even. Most of the beetles jumped off the trees the moment they were touched by the liquid, and only a few (especially those hidden within the dead buds) were caught and enveloped by the emulsion on the trees. These latter specimens did not recover and died; of those that had jumped to the ground I collected a small number in a tin box and found them all dead a few hours afterwards. It may be assumed, therefore, that most specimens that had been touched by the emulsion were killed. In the early morning hours of April 15 there was a heavy rain shower, and an examination of the trees treated the day before with the emulsion showed the presence of a small number of beetles. On the wet ground, however, many apparently healthy beetles were slowly moving about, apparently waiting to get dry before attacking the trees.

The invasion of *Crepidodera rufipes* has plainly a strong resemblance to that of the well-known Macrodactylus; in both cases thousands of newly-arrived specimens replace those that have been killed by the application of arsenical poisons or pyrethrum or kerosene emulsion. In the case of the Crepidodera the arsenical poisons evidently have very little or no effect whatever, since the young trees are mere naked slender shoots, without branches or leaves and with smooth bark. In short, the old method of jarring the beetles down is here plainly more effective, cheaper, and more time-saving than the other remedies just mentioned. To test this method I rigged up my "insect umbrella" (consisting of a piece of common cotton cloth one yard square and kept stretched out by means of two sticks). It was found that a *very slight* knock with a thin stick is sufficient to dislodge the beetles from the trees, excepting the specimens hidden within the dead buds. A stronger knock with the stick is liable to jar the beetles either in the wrong (opposite) direction or beyond the circumference of the cloth. It was further found that, if little judgment is exercised as to the most favorable side where to apply the jar and how and where to hold the cloth, all or nearly all the beetles can be knocked down onto the cloth; in other words, the beetles do not jump off, but simply fall down, following the impetus given by the shock. I convinced myself of this fact by counting in several instances first the beetles on the tree and then, after jarring, the beetles on the cloth. Finally, it was found that this operation can be proceeded with almost as rapidly as a man can walk, and I estimated that a single man could easily attend at least two hundred trees within one hour.

This remedy will be only effective, however, if the jarring is repeated as often as possible—say at least twice each day as long as the invasion lasts. A more handy contrivance than the somewhat clumsy insect umbrella could be easily and cheaply constructed, and from former experience I know that an old parasol which is lined on the inside with heavy cotton cloth does excellent service.

As a mode of prevention, Mr. Murrell suggested to inclose the upper part of the trees within gauze bags. If these bags are properly tied to the stem, they will no doubt protect the trees; but the great expense will no doubt prevent their use on a large scale. In order to be effective, these bags must be at least one foot long and of

a sufficient width not to interfere with the development of the buds. For the protection of single choice trees, however, such bags are no doubt to be recommended.

Should future observations corroborate the connection of the presence of the locust bushes on or near the orchard and the invasion of the Crepidodera, by far the most rational way of prevention would be the radical destruction of the locust thickets. This should, however, not be done as in Mr. Murrell's case, who, as stated before, grubbed up the locust trees in March and at once planted the peach trees on the new ground. The severity of the invasion is thereby evidently increased, for by the plowing of the ground the beetles are disturbed in their winter quarters and appear sooner above ground than they would under ordinary circumstances. The locust trees should be uprooted some time during the summer—*i. e.*, before the beetles have retreated into their winter quarters under the old leaves at the base of the trees or in the ground. The particular month when the beetles go into winter quarters has not yet been ascertained, but it is safe to say that this takes place before the cool season sets in, probably as soon as the month of August.

Besides the Crepidodera, only a single other species of insect was found on the newly-set trees—viz, *Apion nigrum.* I did not observe that it did any damage here, probably because there was nothing left to feed upon on the trees already denuded by the Crepidodera. It was more abundant on the three-year old trees, where it fed upon the leaves, but the amount of damage done was very insignificant. However, the presence of this little Apion on the peach trees is of special interest, since, like the Crepidodera, it belongs to the fauna of the Black Locust, the imago feeding on the leaves and the larva developing probably in the seeds of that tree.* Thus the assumption that there is a connection between the locust trees and the Crepidodera invasion is considerably strengthened.

On the three-year old trees a number of other insects were found, mostly Coleoptera (a few Coccinellidæ and Elateridæ, *Syncta ferruginea, Typophorus canellus,* and *Pandeletejus hilaris*), a few Capsidæ, and an Aphis, none of them abundant or of any special interest. But I utterly failed to find any insect that could be considered as an enemy of the Crepidodera. Mr. Murrell informed me, however, that in one instance he saw a brownish Hemipter spear a specimen of the Crepidodera. Being an excellent observer, he was able to draw from memory a figure of this Hemipter, and I had no difficulty in recognizing one of our Reduviids.

FURTHER EXPERIENCE.

We were anxious to follow up the further experience which Mr. Murrell had, both with the beetle and the experiments made to destroy it, and the following letters from him are sufficiently interesting and instructive to reproduce entire:

LETTER OF APRIL 29.

I was requested by Mr. E. A. Schwarz, while on his visit here, to write at a later date stating effect of kerosene emulsion diluted four times as affecting peach foliage. The trees so treated were about 75 in number, and were showing foliage from buds just opening to leaves about one-fourth developed. Four or five days after spraying the bulk of the lot were defoliated by beetles, and the few yet carrying leaves show no bad effect from emulsion. Six or seven hundred trees sprayed heavily, first with 2 ounces of London purple to 40 gallons of water and a few days later with one-half pound London purple, 2 pounds lime to 100 gallons water, show no difference in appearance or cessation of attack from trees untreated. The weather following both

* See Proc. Ent. Soc. Washington, II, No. 1, p. 76.

treatments of emulsion and poison was cloudy and moist to cool for a period of five or six days.

Mr. Schwarz advised my trying the jarring of the beetles on a cloth saturated with pure kerosene. Following this advice, I made a frame nearly of the shape of a palmetto fan, made by bending barrel hoops and fastening to a forked stick, leaving one prong long for a handle. I covered this with 14-ounce ducking. This gave me a shape that by passing the trunk of the tree into the crotch of the fork nearly surrounded the limbs with the canvas, which was 3 feet in diameter, and proved quite effective, although I would advise the use of a woolen cloth with nap as holding the oil better and preventing the jumping off of the beetles the instant they touch the surface, which fully two-thirds do. With this apparatus kept saturated the beetles can be kept in check during cool weather by passing over the orchard once a day. During warm weather it is nearly useless, as countless thousands are in the air, and two minutes after jarring, by actual count before and after and timing by my watch, I found nearly as many as the first time. Having the beetles between me and the sun, I could plainly observe their flight, and saw they were coming from out the edge of the woods close by, and especially did I notice them circling in large quantities around an old brush heap located just at the edge of the woods. Mr. Schwarz thought it possible that the clearing and fallowing of the land had caused the beetles to hatch earlier than usual. This theory would seem to be borne out from the fact that the trees surrounding a rocky spot nearly in the center of a large field of 1,000 trees have in the last few days been attacked with redoubled violence; but I do not consider this at all conclusive. The woods and locust trees are rapidly getting green, and while I have noticed some beetles on the latter trees both here and on adjoining farms, yet I see no tendency as yet in the beetles to abandon the peach for their natural food plant, and in the last few days they have been worse on my cherry trees than when the leaves were younger. I should be glad to learn the results of experiments with alkalies as affecting foliage. Soot is efficacious in treatment of masticating insects on squash vines, etc., when used dry, and I would be glad to know if it could be used in solution safely and with the same effect

---

LETTER OF MAY 12.

A few beetles are still on my trees, but the trees are fast growing out of their reach. Since May 5 the damage done is not noticeable. It is too early to state definitely the percentage of damage done. In a general way I can say that the pear trees show least ill effects. A number of plums have succumbed and several hundred peach trees are killed to the ground, but are putting up from below ground. The trees were planted somewhat deeper than they stood in the nursery, and it is owing to this fact that I will save a larger per cent than otherwise, as one or more buds were left covered by earth and escaped. None of the peach trees escaped with less than two months' set back, and many from twelve months to total destruction. For a period of three or four days the locust growth divided honors in attention from the beetles, but they are fewer now on both peach and locust, the proportion being about the same on both. One of my neighbors has been troubled with them on young apple trees, and I have noticed them on locust bushes in every portion of the neighborhood that I have visited lately.

CONCLUSIONS.

In spite of its small size—not exceeding one-tenth of an inch—the beetle is readily recognized, even without the aid of a magnifying glass, from its coloration and the sculpture of the upper side, in connection with

its leaping powers. It is oblong-oval in shape, shining and not pubescent; head, thorax, and legs bright red and impunctate; elytra usually bright blue, more rarely greenish-blue, and provided with regular striæ of coarse punctures. The thorax has at its base a large and conspicuous impression which is sharply limited on each side.

Crepidodera rufipes, originally described by Linnaeus in 1758, is one of the numerous species of Coleoptera common to North America and Europe. In the latter country it is a common and widely distributed species, but does not appear to occur in the arctic regions. In North America it is known from the States of New York, Pennsylvania, Maryland and Virginia, and the District of Columbia. There are also two specimens in the National Museum marked "Texas," and Dr. Horn in his Synopsis of the Halticini says "it is now widely scattered over the Atlantic region as far west as Iowa." It seems to be absent, however, in the boreal region, and from this fact it may be assumed that the species does not belong to the circumpolar fauna but has been introduced by the agency of man. If this be so, it was imported at or before the beginning of this century, for it is enumerated in the old catalogue of Insects of Pennsylvania, by F. V. Melsheimer, published in 1806. Forty years afterward (in 1847) it was redescribed by the younger Melsheimer under the name of *Haltica erythropus* (Proc. Ac. Sc. Phila., vol. III, p. 165).

As in the case of many other flea-beetles the imagos of *C. rufipes* appear to feed upon several different plants which are not necessarily the food plants of the larva. Mr. Letzner, in his list of the Coleoptera of Silesia says (2d edition, p. 414) that the imagos are found "in deciduous forests, on *Lathyrus vernus*, *Malva silvestris*, *Vicia sepium*, etc.," while M. E. Olivier, in his "Faune de l'Allier" (II, pt. 1, p. 348) simply says, "on Malvaceous plants on dry meadows." Since in the United States the species feeds chiefly on Black Locust, which does not occur in Europe (except as an imported shade tree) it must be inferred that the beetle has changed its food habits upon its arrival in America. Whether or not a corresponding change has taken place in the food habits of the larva can not be ascertained, since the earlier states and the larval habits are still entirely unknown.*

* Mr. Ed. Perris found the larva of *Crepidodera lineata* feeding openly on the leaves and flowers of *Erica scoparia* in southern France, and gave a detailed description thereof in his "Nouvelles Promenades Entomologiques" (Ann. Soc. Ent. France, 1876, pp. 198–201), but he says, "Although the species of the old genus Crepidodera are pretty numerous and some of the species very common, yet not a single larva of this genus has ever been observed, and the failures of my efforts to find them induce me to believe that none of them save that just described live openly on plants. This peculiarity, in connection with certain structural differences in the imago of *C. lineata* appear to justify the erection of the genus *Arrhenocœla* Foudras for this species."

In the economic literature of Europe we find but a single notice of this Crepidodera, viz, by Kaltenbach (Pflanzenfeinde, p. 141), where he briefly says: "*Sitones lineatus* and *Haltica rufipes* are injurious to young peas and field beans," but while a good deal has lately been written on the Sitones, especially by British economic entomologists, no further notice is made of the Crepidodera, and it is evident that this beetle is by no means a serious pest in Europe. As to the injury done in the United States, there are no records previous to 1887, when Mr. Murrell, on whose farm at Coleman's Falls, Va., the invasion of 1893 took place, sent specimens of the beetle to Prof. J. A. Lintner, who, in his Fourth Annual Report, pp. 101–103, devotes a short chapter to the insect, including Mr. Murrell's account of the invasion of that year.

One year afterward another invasion was reported to us by Messrs. Stover & Stover, Edgemont, Washington County, Md., in a letter dated May 15, 1888, which is published in INSECT LIFE, vol. I, p. 280.

Finally, the present year, a few days after Mr. Schwarz's return from Coleman's Falls, Prof. Van Deman, chief of the Division of Pomology, referred to us a letter from Mr. W. A. Powell, of Lexington, Va., in which complaints were made of the sudden appearance in injurious numbers of a small beetle on young peach trees. No further particulars were given, nor were there accompanying specimens, but there can be little doubt that the invaders were the same *Crepidodera rufipes*.

It will be noted that all these reports are from the slopes of the Alleghany Mountains, which is just the region where, in the experience of our field coleopterists, this Crepidodera is far more abundant than elsewhere.

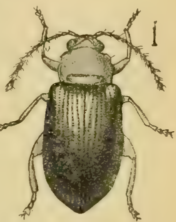


FIG. 47. *Crepidodera rufipes*—enlarged. (Original.)

It will be further noted that in all these instances the invasion took place early in the spring, and it would appear that later in the season, when the orchard trees have acquired their full foliage, these attacks cease and the beetles feed upon the leaves of the locust bushes. Similar attacks on the part of other flea-beetles are on record. Thus we recorded in INSECT LIFE, vol. I, p. 221, the appearance of great numbers of *Haltica ignita* on grapevines in the Salt River Valley of Arizona during the first part of April. The same species appeared toward the end of March in enormous numbers on strawberries at Orlando Fla., (l. c., II, p. 369).* A remarkable case of the early appearance of another flea-beetle is also recorded in INSECT LIFE (vol. IV, p. 401), where

* Prof. F. M. Webster's short note in INSECT LIFE, III, pp. 317–318, is of special interest, for he reports that this Haltica appears on the strawberry plants in the months of July and August, injuring the young foliage which appeared after the strawberry-bed fields had been burned.

Mr. C. H. Rowe, of Malden, Mass., reports that as early as March 25, when the weather was quite cold and snow to the depth of 6 inches was on the ground, swarms of *Haltica carinata* were found on his elm trees. In all these cases only the imagos of the Halticids were observed, and it is safe to say that the plants mentioned are not the food plants of the larvæ.

Whether or not the discovery of the food plant and habits of the larvæ of *Crepidodera rufipes* will materially add to the means at our command in dealing with the injury can not now be predicated. If the larva should be found to live on the roots of locust bushes the destruction of these would prove advantageous in the vicinity of young orchards. On the other hand, if the real food plant of the larva is scattered throughout the woods or meadows its discovery would be of little practical importance.

EXTRACTS FROM CORRESPONDENCE.

The "Overflow Bug" or "Grease Bug" a Plague in California.

I send you in the inclosed box a "grease bug," so called, I presume, from its disagreeable odor when crushed. They are among our worst pests about the house, coming in swarms so they sound like a rainstorm on the side of the house. They attack all kinds of food, eating holes into the interior of bread, etc., but preferring meats. I have had many bird-skins destroyed by their eating the lores and adjacent parts when drying. They stop here all summer, finding some damp place, where they congregate in immense numbers. I have seen at least a peck under one haycock in the field, and nearly every cock with them. They crawl up the sink-drain into the closet under the sink, and I have taken them from here by the double handful, dropping them on the hot sand, when they invariably kicked their last in less than half a minute.

I had thought they bred in the dead stock on the swamp, but the country about Wheatville is nearly free from them, and that is nearer the swamp than this place.—[A. A. Eaton, California, May 12, 1893.

NOTE.—A similar account of undue abundance of this insect (*Platinus maculicollis*) was given us some years ago by Mrs. A. E. Bush, another of our California correspondents, her letter being published by Riley in a note entitled "The Overflow Bugs in California," in the *American Naturalist* of August, 1882 (pp. 681–682).—[Eds.

Is the English Sparrow instrumental in suppressing the Horse Bot-fly?

I am sending you specimens of a fly, together with its larva, which is causing much trouble amongst our horses in this colony. There is a difference of opinion as to its identity, some asserting that it is the English Bot-fly, others that it is not. The nearest approach which I can find to it is at page 623 of Harris's Insects Injurious to Vegetation (Flint ed.), where we find the brown farrier bot-fly "*Gasterophilus veterinus*." One fly darts on to the throat of the horse, depositing an egg on a hair at each operation. The animals frequently become frantic as these flies approach them. Farmers have adopted the remedy of tying a piece of sacking under the jaw, which prevents the fly from depositing her eggs on that particular spot. I notice that Dr.

Daniel Berry, Carmi, Ill., Mr. W. E. Dingman, of Newton, Iowa, and Prof. Charles Linden, Buffalo, N. Y., all agree that the Bot-fly has become much less troublesome in their several States of late years, and they appear to think that the English Sparrow is answerable for this good service, as they are supposed to capture the larva as it is ejected from the horse in his droppings. If you will kindly aid us in this matter by giving us your opinion as to the exact identity of the fly, we shall esteem it a very great favor.—[W. Murphy, Canterbury Agricultural and Pastoral Association, New Zealand, March 29, 1893.

REPLY.—I am pleased to receive the specimens, since they indicate the presence in your colony of the old and well-known *Gasterophilus nasalis* Linn. You were perfectly correct in your identification, since *Gasterophilus veterinus* Clarke is simply another name for the same species. Your account of its habits is also correct, and quite as we find them in this country. I think it quite likely that the idea that the English Sparrow is of service in reducing the numbers of this insect is correct. It is a prevalent notion in this country, and it is claimed by a number of observers that the horse-bot has become almost unknown in certain localities since the advent of the sparrow. There is no proof of this statement, however, founded upon actual observation of stomach contents, nor, so far as I am aware, have sparrows been observed to feed upon the bots voided by horses. In an examination of the contents of 522 sparrow stomachs made in this office, some four years ago, no specimens of the bot-fly or its larva were found. The details of this examination are given by me in Bulletin No. 1 of the Division of Economic Ornithology, entitled, "The English Sparrow in North America, Especially in its Relations to Agriculture," by W. B. Barrows, published in 1889.—[May 29, 1893.]

Notes on some Gall Insects and Parasites.

Orthopelma diastrophi Ashm. was bred from galls of *Rhodites radicum*. If *diastrophi* be not a misnomer, is it not curious to find it in a Rhodites gall?

Rhodites (?) *utahensis* Bass. is the producer of a gall found on the roots of *Rosa blanda*—very distinct from *R. radicum*.

Orthopelma luteolator Gr. is a very common parasite in galls of *Diastrophus turgidus*, and has been so for the last twenty-five years.

Orthopelma luteolator Gr. is a very common parasite in galls of *Rhodites rosæ*, and has been so ever since the galls appeared here.

Entedon sp. is from galls of *Gelechia gallæ-solidaginis* Riley, the pupa of the parasite remaining within the pupa case of the moth all winter and the imago comes out the following spring.

Torymus rudbeckiæ Ashm. is from Cecidomyiid galls on stems of *Desmodium acuminatum*.

Catolaccus sp. is from galls of *Biorhiza forticornis* and is very rare.

Tetrastichus sp. is from galls of *Rhodites vernalis* and is also very rare.—[William Brodie, Toronto, Canada.

An Intruder in California Vineyards.

Herewith please find a specimen of an insect called to my attention by a neighboring vineyardist which is alleged to be doing much damage to the young fruit buds and blossoms of the Muscat grape vine at this particular period. This insect has been recognized by many residents as a yearly visitor. It appears in spring, and was heretofore known as a pest infesting rose leaves and doing much damage to the young buds.

They are said to be very numerous on some vineyards, as many as hundreds to a single vine. In one case about three acres are reported to have been completely stripped of grape buds. Bordeaux mixture and Paris green in spray has been used on the infested vines without apparent benefit.

Vineyards in this immediate vicinity, 4½ miles east of Selma, do not show any trace of the insect, but they are found in rosebushes around our dwellings.

Do you recognize the species and do you know a remedy?—[J. D. Power, Fresno County, Cal., May 17, 1893.

REPLY.—* * * The insect which you send is a leaf-feeding beetle known as *Hoplia callipyge*. Since the Paris green has been tried without effect, you are advised to spray with dilute kerosene emulsion.—[May 24, 1893.]

Living Insects in the Human Ear.

In your last issue of INSECT LIFE I read your note on "Living Larvæ in the Ear." It is so like a case recounted to me yesterday that I feel like repeating it. A farmer said about one and a half years ago a small green fly—he thinks it was smaller than a house fly—buzzed around his head, and despite his efforts to drive it away it entered his ear. It caused him much discomfort, scratching against the drum of the ear. He tried to drive it out by slapping his ear; a friend worked in his ear with a double grass blade; at length the fly came out and flew away. That night about 2 o'clock he awoke with pain and terrible noises in his ear; he introduced a camel's hair pencil, moistened with oil, and found living maggots attached; after extracting he went to a doctor, who syringed the ear out with a decoction of tobacco, removing 19 small white larvæ of different sizes; he removed one dead one after he went home (27 in all). I called upon the doctor to-day, who confirms the story, tobacco juice and all; the larvæ or the treatments caused partial deafness for several months, but at length nature has restored the normal hearing capacity. I am sorry not to be able to give the name of the fly, as the farmer and his doctor paid no attention to that.—[Henry Shimer, Illinois, December 9, 1891.

Eucalyptus vs. Mosquitoes.

I have the largest and oldest grove of trees of *Eucalyptus globulus* in this part of California, and have had fifteen years of opportunity to study these trees as insect repellants, and deem it my duty to respond to your request on page 268 of INSECT LIFE.

Thirty-three years ago I spent a portion of one summer with a Dr. McConnell, who had just returned from some years of residence among the Eucalyptus forests of Australia. We were in the Sequoia (*Sequoia sempervirens*) forest of the coast region of our State. The mosquitoes were so bad there it was nearly impossible to work during days when there was no wind. The doctor assured me that our common mosquito was never found in the Australian Eucalyptus forests and swamps, but added there's a "spotted mosquito" nearly as bad there in some places. He not being an entomologist, was unable to tell me whether the "spotted mosquito" was a species of the genus Culex, or of some allied genus.

The doctor being a reliable, close observer, I determined to test the anti-mosquito qualities of the Eucalyptus, so when I began to improve my house here nineteen years ago, one of the first things I did was to get a lot of Eucalyptus seed from Australia and plant out a grove of the trees. The tallest of them are now over 140 feet tall, and can be seen for 20 miles around. My house stands in the midst of these trees. My irrigating ditch, a dozen feet wide, of sluggish current, runs through the grove beside the house. There has never a single mosquito larva been seen in this ditch from where it enters the first shade of these trees to where it emerges from them 200 yards away; while above and below mosquito larvæ are plentiful—not immediately below, but some hundreds of yards away, where the water stands in pools and becomes stagnant among a growth of black walnuts and cottonwoods.

My live stock pasture in this timber, going into the walnuts and back again under the Eucalyptus shade at pleasure. Frequently when the cows come up at night they

bring a swarm of mosquitoes; occassionally some of them get into the house, but cause us so little annoyance that we scarcely notice them. Before this ditch reaches the Eucalypti it runs through a jungle of "fence bamboo" (*Arundo macrophylla*), where the mosquitoes are so bad that we avoid working there except on the windiest days. And, though the ditch has more currents there, the larvæ of mosquitoes are plentiful in the water till it reaches the Eucalyptus trees, below which point none are found, till it has become stagnant away below them.

People who have camped among the willows of Kings River, only a few miles away, have come here with faces so blotched and swollen from mosquito bites as to be hardly recognizable, and have camped in the shade of "Sanders' Gum Trees," as my grove is popularly called, for weeks, and declare that they never even heard a mosquito sing during that time.—[W. A. Sanders, California.

P. S.—To the non-botanical reader I may say this species of Eucalyptus is very tender as to frost. The coldest weather ever known here, 19° F. above zero, killed thousands of them.

Another vegetarian Mosquito.

Since writing to you last I have seen another vegetarian mosquito, possibly a descendant of the one I saw last year, as it was in the same place. I think this may be a new strain, or perhaps they belong to the total abstinence club. At all events let us hope they will continue to inherit acquired characteristics; it may be they will reform the race, as it were, and from mosquito bars and insect powder be combated with rose nozzles and Bordeaux mixture.

The mosquito in question settled on some apple sauce upon the table. She had a better time of it than the other one I saw, as she soon drank her fill of the juice and flew heavily away.—[A. A. Eaton, California.

Insect Injury to Cactus Plants.

I send you some bugs found on some Cactus plants. I have three species of Opuntia, which I am growing for ornament, namely, *Opuntia rafinesqui* (?), *Opuntia engelmanni*, and *O. leptocaulis* (*frutescens*). I had a patch of *O. rafinesqui* and *O. engelmanni* mixed, about twelve feet in diameter. It was a sight to look at when in bloom, but to-day they are all dead.

As a general thing the cactus family is looked upon as an enemy of mankind, but take away *Opuntia engelmanni* from portions of Texas and the rest of the cactus kind and there will be but little left to feed stock upon in case of protracted droughts. If this insect works all over the State as it does here it will be a very short time before all the Opuntias are exterminated. They are equally bad on the three named species, and since I have seen what they are doing I am killing every one I can get hold of. I do not know whether they attack such genera as Cereus, Echinocactus, or Mamillaria, for I did not have any of the above-name genera. If you receive these bugs in good condition you can experiment with them in your vivaria. Last year was the first time I observed them. They are out again in full force this year.—[F. W. Thurow, Harris County, Tex., March 17, 1893.

REPLY.—The bugs which you send as injuring Opuntias belong to the species known as *Chelinidea vittigera*. Your account of their habits is of considerable interest, as they have not before been found in such enormous numbers. You will find them very difficult to destroy, and while I have no experimental knowledge of the action of kerosene upon these cacti, I fear that an emulsion strong enough to kill the bugs will also kill the plants. However, if you are willing to sacrifice those plants which are most badly affected, you can certainly kill the insects at the same time, either by the use of pure kerosene or a strong emulsion. Should you think it worth while to conduct any experiments, I should be pleased to learn the result. The specimens which you sent arrived before your letter, so that all had been killed

and mounted before your suggestion as to experimentation was read. You are in position, however, to experiment very much more advantageously than we would be with living material which had been sent through the mails.—[March 25, 1893.]

Gapes in Fowls.

Poultrymen know that the disease known as "gapes" in fowls is due to a worm lodged in the windpipe, and some of them believe the worm to be a parasite of the common angle or earth-worm.

Is there any foundation for such belief? An answer through INSECT LIFE may gratify others as well as myself.—[George Wentz, Maryland, May 20, 1893.

REPLY BY DR. C. W. STILES OF THE BUREAU OF ANIMAL INDUSTRY.—In reply to your letter dated May 22, 1893, inclosing a communication from Mr. George Wentz, of Catonsville, Md., permit me to state that the disease of poultry known as "gapes," "verminous tracheoboronchitis," or "syngamosis," is caused by a nematode (round-worm) to which Siebold has given the name *Syngamus trachealis*. The parasite belongs to a family (*Strongylidæ*) the members of which do not require any intermediate host for their development. Accordingly, we should not expect to find this worm as an obligatory parasite of the earth-worm. It is, however, beyond question that chickens may occasionally become infested with the parasite in question by swallowing earth-worms. This point will be evident from the following account of the life-history of the parasite.

The adult parasites are found in the trachea of poultry, the male being very firmly attached to the female. Numerous eggs are formed in the female parasite and in each egg a small embryo is developed. Females 20^{mm} in length have fully developed embryos in their uterus. According to Cobbold and Megnin these eggs with the contained embryos are not laid, but they escape from the adult worm only after a rupture of the body. This fact is easily understood when we recall that the male is intimately united with the female at the height of the vulva, so that the genital opening is practically sealed.

If the adult parasite is now coughed up by the affected chicken, or if it becomes liberated through the death of the fowl, the eggs will become scattered on the ground. They may remain unchanged for some time, or in a warm moist medium the embryo may escape. Should these eggs or embryos be swallowed by other chickens, they will gain access to the trachea and cause the "gapes." If an earth-worm should happen to swallow any of these embryos or eggs, the latter will retain their vitality for some time and will infect with gapes any chicken which happens to devour this particular earth-worm. Thus it is clear that the earth-worm may transmit gapes to chickens by acting as a carrier of the embryos or eggs, *but that the earth-worm is not a necessary factor in the transmission of this disease* is equally apparent.

The following experiments will undoubtedly be of interest to your correspondent:

Dr. Walker observed that the embryos of *S. trachealis* would retain their vitality when swallowed by earth-worms, and that birds contracted "gapes" upon swallowing these earth-worms. (For Walker's experiments see Second Annual Report, Bureau of Animal Industry, U. S. Department Agriculture, 1885, pp. 274–277.)

Mégnin infected a parrot with "gapes" by feeding to it some of the female parasites containing embryos. (For Mégnin's experiments, see a translation of his article in First Annual Report Bureau of Animal Industry, 1884, pp. 281–296.)

Ehlers fed eggs of *S. trachealis*, containing embryos, to birds, and after twelve days he found copulated parasites in the trachea.

From the account given above it is clear that fowls may contract "gapes" by any of the following means:

(1) By swallowing eggs or embryos of *S. trachealis* which happen to be in their food or drinking water.

(2) By swallowing the adult female parasite filled with eggs, which has been coughed up by some other fowl and which, on account of its reddish color, chickens might mistake for an earth-worm.

(3) By swallowing earth-worms, which may by chance happen to contain the syngamus eggs or embryos in their digestive tract.

The knowledge of these three possible modes of infection suggest several very practical means of preventing the spread of this disease:

(1) As soon as it is noticed that a flock is affected with gapes, *the infected chickens should at once be isolated* and the healthy members of the flock should be placed on other ground where no infection with eggs exists. The infected chicken-yard should not again be used for at least a year.

(2) *The bodies, or at least the entrails, including the trachea, lungs, etc., of all animals dying from this disease should be burned.* If the bodies are simply buried the earth-worms may bring the embryos to the surface and thus infect the rest of the flock.

(3) Poultry yards should be provided with drinking-troughs, so that the fowls will not be obliged to drink water from contaminated and stagnant pools.

(4) Poultry yards should occasionally be treated with lime in order to destroy the embryos of the parasite.

(5) During the season in which the disease appears chickens should be kept housed unt l after the sun is well up, say 8 or 9 o'clock.

The Clover Mite in Houses.

I send specimens of a pest which has caused me great trouble for three or four years. About the second week in February thousands of these creatures cover my window sills and panes. When they first appear they are about the size of a pin point. They are then a very bright scarlet. They are now fully grown. For weeks they have covered everything—windows, books, furniture, cushions, and pillows. They are not in sight in the evening. They travel constantly back and forth through the day. About the middle of June they disappear, leaving every crack and crevice filled with a line of white eggs. They often pack solidly in places, and then form a column and march up the casings of the windows. The matter is very serious. Is there any way to determine what they are, and how to be rid of them? If this pest becomes universal it will certainly cause great trouble.—[Mrs. Francis A. Smith, New York, May 26, 1893.

NOTE.—The insect sent was the Clover Mite (*Bryobia pratensis*), a full account of which has been given in INSECT LIFE, vol. III, p. 45.—[EDS.

The Utilization of Spider Silk.

I notice in INSECT LIFE, vol. V, No. 3, p. 210, a note relative to the silk of spiders, which sums up my experiments and attempts on the subject. The author of the note concludes by remarking that the most important desideratum is the means of obtaining or raising the spiders in large numbers.

Réaumur, in discussing the attempts of Bon, had raised the same objection. The difficulty now seems to be removed in the case of the large spiders of the genus Nephila of this country. Dr. A. Vinson, in his "Étude sur l'Arachnologie des îles de la Réunion, Maurice et Madagascar" (p. XXIV), remarks that these large spiders "may live in families," and I have myself observed that our "Halabe" of Madagascar (*Nephila madagascariensis*) multiplies rapidly and may be obtained in large numbers, living gregariously in the open air, without any care being taken of them. Not far from Tananarive, at Ambohips, the Catholic mission possesses the beginning of a garden of acclimatization and study, in which I lately counted about a hundred of the female "Halabes," already of good size, in the space of about a cubic meter.

In working with the large Nephilas it would be possible, if I am not mistaken, by taking some pains, to obtain, either in the open air or under covered sheds, a sort of spider magnanerie, in which the floss of the cocoons and the thread drawn from the living insect by the processes I have indicated or better ones, could be utilized.—[P. Camboué, S. J., Madagascar.

Further concerning the new Chicken Plague in Texas.

In No. 4, INSECT LIFE, I find your report to the Department on *Argas americanus*, a new chicken plague as you call it. Doubtless it will be of interest to you to hear more about it. I am well acquainted with this pest since the fall of 1888, when I for the first time found them infesting a chicken house on a neighbor's ranch, killing in a short time about 25 to 30 chickens. They are strictly nightly in their habits. I never saw one about in daytime, and alike numerous in summer as in winter, but they seem to appear in greater numbers in dry, hot years as 1892 has been. They spread very rapidly. Last year I built a new chicken house, but in eight days it was literally full. You state in your report "Pullets it kills by creeping in masses under their wings." This would suggest that the grown Argas does the work. Allow me to correct this. It is the young, apparently newly-hatched, that do this. Perhaps the eggs are deposited under the wings and along the neck of chickens. They are minute little fellows hardly as big as half a pin's head and fasten themselves like ticks, but in such numbers that the skin is perfectly covered. Chickens droop, refuse to eat and drink, in a few days they are unable to move and finally die. What becomes of the Argas after they kill their host I do not know, but will try to find out. The damage done is indeed great, not only killing old and young chickens but weakening them so that their laying qualities are greatly lessened. Kerosene oil emulsions seem not to have a great effect upon Argas. Lime and sublimate when the houses are whitewashed seem to do much better. Oil of sassafras kills them quickly, but is rather dangerous if put on little chicks.—[Ferdinand Hoehr to Albert Turpie, Kinney County, Tex., and transmitted by the latter to this Department.

Painful Spider Bites.

Referring to the letter from Dr. William P. T. Cook (INSECT LIFE, vol. II, p.255) in which he infers that spiders do not bite, I wish to add a mite of testimony. During the past year (1892) I have been twice bitten by spiders; in both cases experienced the bite and saw the spider.

Last summer while on a fishing excursion at Reservoir Lake, Saratoga County, N. Y., I experienced a sharp, stinging bite on my neck and on brushing off the biter discovered it to be a small spider of a silver gray color. A companion at once crushed his spidership, for which on afterthought I was sorry, as I should like to have sent the spider for examination. At the spot bitten a small red puncture was visible which was soon surrounded by a swelling somewhat similar to a bee sting. Sharp twinges of pain followed with stiffening of the cords of the neck and I was not a little alarmed, especially as I had not long before read some of the correspondence in INSECT LIFE relating to the subject. However, the pain soon left, swelling went down, and fishing was resumed. The only effects afterward noticed was a slight stiffening of the neck lasting for a few hours and once only on the following day a very sharp contraction or spasm of pain in the region affected.

The other bite spoken of was somewhat similar to a slight bee sting but with no effect of any consequence. Should anything further pertaining to the subject be noticed I will communicate if desirable.—[P. M. Van Epps, Schenectady County, N. Y., March 20, 1893.

Supposed Gall-Mites on Blue Gum.

I send some leaves of the Eucalyptus Blue Gum or the *Eucalyptus resiniferus* infested with scales out of a garden where *Aspidiotus aurantii* has been imported by the reckless transfer of a rose tree from a garden in Misoria infested with Red Scale. At least that is the decision that I arrived at, but the villagers are convinced that the disease on the orange and lemon trees has spread from the Eucalyptus. It is in a part of the island where up to the present Red Scale had been unknown, but strange to say I have not noticed this disease on the Eucalyptus in any other part of the island, neither is there any other Eucalyptus, but the two infested, within a radius of ten miles, neither have I noticed this particular disease on any other trees.

The village is situated about 300 feet above the sea and about one mile from the northern coast. * * * —[Alfred K. Bovill, Nikosia, Cyprus, February 6, 1893.

REPLY.— * * * The Eucalyptus leaves have been carefully examined for both insects and fungi. Mr. B. T. Galloway, Chief of the Division of Vegetable Pathology of this Department, has carefully examined them for fungi and has been unable to find any trace of Mycelial or other fungus growths. We have sectioned and examined them for traces of insect work and can not find any evidence of such work. The larger of the spots are seen to contain, upon removing the epidermis, one or more minute pits, lined with a glistening amorphous substance resembling, to some extent, the pits occupied by the gall-mites or rust-mites of the family Phytoptidæ, although no trace of any mite or of a cast skin of one of these creatures can be found. The most likely hypothesis, however, is that the damage is done by some member of this family, but this can only be determined by an examination of fresh material, and that can only be done in Cyprus. If you have a compound microscope at your disposal you should be able to settle the question yourself. If this theory prove correct, the best remedy will be to collect and burn all fallen leaves and by a careful study to determine the period when the mites are not inclosed within their galls, at which time they may be destroyed by the application of a dilute kerosene emulsion to which a small quantity of flowers of sulphur has been added. This course is pursued against *Phytoptus pyri*, a similar creature, which damages pear trees in this country.—[March 17, 1893.]

NOTES FROM CORRESPONDENTS.

In Favor of the English Sparrow.—Good words for this important pest are so rare that it is almost a pleasure to record that our correspondent, Miss Jennie R. Bush, of San Luis Obispo County, Cal., finds it destroying a scale insect upon the climbing rose. The species of scale has not been determined.

The Tomato Worm in the Leeward Islands.—Mr. C. A. Barber, of Antigua, sends us specimens of the common *Protoparce cingulata*, with the statement that it is doing great damage to fields of sweet potato on the island of Antigua.

Early Locust Ravages.—Mr. F. A. Swinden, of Brownwood, Tex., informs us under date of March 21 that young grasshoppers are hatching out by the thousands in the vicinity of Brownwood, and that 200 acres of crops were destroyed last year and many eggs deposited. He has not sent in specimens, so that the species has not yet been determined.

The Indian Meal Moth.—In INSECT LIFE, Vol. II, pp. 170–171, we gave a long list of the substances upon which we had found the larva of *Plodia interpunctella* to feed. We add to this published statement the fact that we have recently received specimens from Mr. A. S. Fuller, of Ridgewood, N. J., which were found feeding upon stored seeds of the Salamander lettuce.

The Horn Fly in Southwestern Texas.—Mr. J. D. Mitchell, of Victoria County, Tex., sends us specimens of the Horn Fly, which, he says, made its appearance in that county in the fall of 1892. They are very abundant this spring, and reached

Texas, according to Mr. Mitchell, from Kansas and Indian Territory, and are known by the appellation of the "Third Party Fly." An interesting point in connection with this geographical distribution is that the slight wound made by the flies or by the cattle in their efforts to allay the irritation of the bite affords a spot of entrance to the Screw Worm.

A North American Chalcidid in England and the West Indies.—We have received from Mr. A. J. Tillson, of the Department of Agriculture of the Leeward Islands, St. Johns, Antigua, specimens of *Spilochalcis mariæ* (Riley) which had issued from cocoons of *Attacus cynthia* received from England. The parasites must have attacked the larva in England and the species has undoubtedly been introduced into England by English entomologists (perhaps by M. Alfred Wailly), in their importations of American silk worms.

The Jamaica Ephestia.—In a previous number of INSECT LIFE we referred to the fact that the Mediterranean Flour Moth (*Ephestia kühniella*) had been found at Kingston, Jamaica, by Mr. T. D. A. Cockerell. Recently Mr. Cockerell has written us that he has sent specimens of the moth to M. Ragonot, of Paris, who determines the species as *E. desuetella* Walker, and that it is, therefore, not *kühniella* as Mr. Cockerell had previously supposed.

A New Enemy to Prune Trees in California.—Mr. D. W. Coquillett has sent us specimens of *Eurymetopon cylindricum* Casey, which he received from Mr. Geo. E. Stewart, of Nordhoff, Cal., through Mr. J. F. McIntire, one of the County Horticultural Commissioners, of Ventura County, and which Mr. Stewart states were found upon prune trees, the leaves of which they had eaten to some extent. This beetle belongs to the family Tenebrionidæ and this habit has not, we believe, been previously recorded.

A California Scarabæid on Plum.—Mr. Alva A. Eaton sends us from Riverdale, Cal., a specimen of *Serica anthracina* Lec., a small brown Scarabæid beetle, with the statement that it feeds on the foliage of Plum.

Larvæ supposed to have fallen during a Shower.—We have received from Mr. James Fletcher, Entomologist to the Dominion of Canada, Ottawa, specimens of a Carabid larva probably belonging to the genus Patrobus which he had received from Cleveland, Ohio, and which was said to have fallen in large numbers in a shower during the latter part of March or early part of April. This supposition was in all probability erroneous, as these larvæ, from their known habits, had probably issued from the ground during the rain storm.

Damage by May Beetles.—Mr. W. C. Brass, of Carlisle, Ark., writes us that April 7 and April 16 large swarms, comprising millions of May beetles, appeared in the vicinity of Carlisle. The nursery of Mr. Thomas Marson was completely stripped of leaves, while in a patch of woods south of the nursery the trees were entirely defoliated and presented a wintry appearance. The wood patch was a mile in length and one-fourth or one-half mile in width. The Oaks and Sweet Gums were most affected, although Elm, Maple, and Hickory were also attacked. Specimens received later from Mr. Brass show that the species were *Lachnosterna micans* and *L. nova.*

Birds Eating the Catalpa Sphinx.—Mr. Ben M. Hagey, of Paragould, Ark., writes us that the *Sphinx catalpæ* is very numerous the present season in his vicinity, and that the only birds which he has found feeding upon the larvæ are the common Catbird and Baltimore Oriole.

THE CHERRY-TREE TORTRIX.

GENERAL NOTES.

THE CHERRY-TREE TORTRIX.

This common and widespread species, originally described by Fitch in 1856 as *Lozotænia cerasivorana*, and now placed in the genus Cacœcia, is found all over the United States east of the Rocky Mountains and possesses the habit of feeding gregariously in the larval state, all of the caterpillars hatching from one lot of eggs and feeding in a community inclosing the leaves on the end of a branch in a silken web, which is extended to include more food from time to time. The blackish excrement is deposited in a large mass in the center of the web, and the larvæ when full-grown transform within this mass. When about to emerge the pupæ work their way partially out in order that the moths may easily escape. The caterpillars feed normally upon wild and cultivated cherry, but what is in all probability the same species has been found by Dr. Packard upon *Betula populifolia* and by Dr. Kellicott upon ornamental birches in Columbus, Ohio. We have recently received from Dr. F. W. Russell, of Winchenden, Mass., an interesting photograph of a series of webs of this insect which was extremely abundant in his vicinity during the summer of 1890. His accompanying statement is so interesting that we publish it with a reproduction of the photograph (see Plate IV).

I send you herewith some photographs of huge tents made by the larvæ of *Tortrix cerasivorana* F., during the season of 1890.

About fifteen years ago I found a single nest of this species and from it raised a number of the moths, one striking variety, two of ichneumons, and a rather handsome gray fly.

Year by year the number of these nests has increased, but I was hardly prepared for the wonderful increase of 1890. For a distance of 1,500 to 2,000 feet along one side of a country road there were thousands of these nests. I counted over 3,000 at one time. Many of them were over six feet high. I placed one of my attendants, a tall young fellow of over six feet, among them, and had their picture taken. The webs often spread over the smaller herbage at the base of the choke cherry bushes, then over the grass, and in great sheets out over the gravel, even to the wheel tracks, where they were torn to pieces by the passing teams. When riding by in the moonlight they presented a peculiarly weird appearance. They extended even to maple, wild cherry, and ash trees, though only rarely and where these trees happened to stand among their more normal food. I do not know that the caterpillars actually eat of these leaves.

I found quite a number of small camps in other localities about town where I had not previously seen them.

The next year, 1891, they were not common at all, even in the locality where they had been so excessively abundant in 1890, but even two years later great masses of leaves, frass, and web remained to disfigure the bushes.

AN IMPORTANT CONTRIBUTION TO INSECT EMBRYOLOGY.

Mr. William Morton Wheeler's inaugural dissertation for the degree of doctor of philosophy, as presented to the faculty of Clark University, the present spring, has been published in the Journal of Morphology

and the author's large reprint has just reached us. While we are not deeply versed in the subject of insect embryology, this work strikes us as a very able production. It covers 148 pages and is illustrated by six large folding plates. The subjects treated are: The embryonic development of the Locustidæ; Gastrulation in the Orthoptera; the indusium and its homologues in the Arthropoda; General considerations of the embryonic envelopes and revolution of the insect embryo; Neurogenesis in the Insecta; the development of the reproductive organs in the Insecta; the subœsophageal body in Xiphidium and Blatta; Technique; Bibliography. The species among the Locustidæ to which he has devoted his principal attention are *Xiphidium ensiferum* and *Orchelimum vulgare*, and certain biologic facts of interest concerning each species are placed on record incidentally to the main purpose of the work. He has made the Orthoptera a starting point in his studies, with a view of determining their relations to the Apterygota on the one hand and to the higher orders on the other; for, although the primitive and synthetic character of the Orthoptera has been recognized by comparative anatomists, the full importance of the group, according to Dr. Wheeler, has been but little appreciated from the embryological standpoint.

INSECTS SAID TO FORECAST THE WEATHER.

In reply to our suggestion on page 138 of the current volume our valued correspondent, Mrs. M. E. Rice, of Coryville, Pa., sends us the following local ideas concerning insects and the weather:

It is a common superstition here that the *black* markings on the *larvæ* of *Pyrrharctia isabella*, or "Wooly Bear" as it is commonly called, foretell the severity of the weather during the winter. If the black is longest on the head end the forepart of winter will be severest, and if *vice versa*, then spring will be coldest. Now some of the larvæ are *black* at *both* ends, some either one or the other end, while some are not *black at all*, or faintly marked. Whether this variation is owing to sex or food or environment I know not. A continuous flight of Dragon flies is said to portend a wet spell (I should say follow a dry spell). Observation shows that a sudden inroad of flies is a portent of rain. Spiders lie dormant in winter; before a thaw they liven up. An irruption of black ants in my house when the thermometor has for weeks hovered below zero, means to my mind an open spring. Such an one occurred last 20th of February and caused me to prophesy mild weather. I was derided, as we generally have "six weeks winter in March" here, but events proved that I was correct. Snails (spiral snails) crawl about only on the approach of wet or cloudy weather. You may expect rain in six hours from their appearance.

WHAT CONSTITUTES A SPECIES.

One of our correspondents who is just beginning the study of systematic entomology has recently written us inquiring what constitutes a species. To this inquiry we have made the following answer:

Your question regarding what constitutes a species is a broad one and not easy to answer in brief. In the abstract, a species is limited by the capacity of its individuals of both sexes to couple and produce fertile offspring, and to continue this indefi-

nitely. The concrete proof of such capacity with species in entomology is seldom obtained, and we have, therefore, to rely upon an assemblage of characters which differ in their relative value in different groups. A character accepted with justice as of specific value in one group may have varietal weight in another and generic value in a third. The consensus of opinion among the best authors in a given group should decide the question of relative importance of any given character. You will gather from my writings in the past on the subject of classification that most of the definitions we are employing are purely conventional, and that we have, for the most part, in nature, but a series of alliances. The test of continuous perpetuation, whenever it has been made in different orders of insects, has always enlarged the conceptions of specific limit by showing a much greater variation than has been previously inferred; in other words, experience tends to what is known as lumping in specific characters, while the beginner is very apt to see specific characters in the minutest differences. The philosophical way of defining species is to allow value only to those characters which prove absolutely constant, and to denote as varieties or subspecies those differences which, inferentially, we are justified in believing to be non-specific.—[C. V. R.

THE RAVAGES OF BOOK WORMS.

Science for March 24 (vol. XXI, p.158) contains under the above title an account of the ravages of three species of insects in books. Dr. Samuel A. Green, at a recent meeting of the Massachusetts Historical Society, exhibited two volumes that had been ruined by the so-called "book-worms," and made some remarks on the subject. His notes, together with a letter from Mr. Samuel Garman, to whom the insects were referred, are published in full. The species that wrought the mischief in this instance are common household pests and are identified by Mr. Garman as *Lepisma saccharina* (?), *Anthrenus varius*, and *Blatta* sp., the last mentioned being identified from its egg cases and excrement.

FURTHER ON BEE STINGS AND RHEUMATISM.

Mr. John Worthington, U. S. consul at Malta, has sent us a clipping from the *Malta Standard* of April 11, which states that the theory that the virus of the bee sting is an infallible remedy for acute rheumatism has received most unquestionable confirmation from the practices of the country people in Malta. Bees are said to be plentiful in the island and the virtue of the sting as a cure for rheumatism has been long established. It is, in fact, said to have been a common practice for generations past to resort to this remedy in all severe cases, the results being most favorable.

THE MEDITERRANEAN FLOUR MOTH AGAIN.

At the meeting of the Entomological Society of France, of December 28, 1892, M. Ragonot refers once more to the question of the origin of *Ephestia kuehniella*. He mentions the adoption of the name "Mediterranean Flour Pest" by the English, and the popular idea in Europe that the insect had been imported from America in flour or grain. Without wishing to discuss the merits of the question he called the attention of the society to the fact that a species of the family Phyci-

tidæ, discovered in the district of Wollombi, New South Wales, and described by Mr. A. W. Scott in the Proceedings of the Zoölogical Society of London, 1859, under the name of *Hyphantidium sericarium*, belongs evidently to the genus Ephestia, and closely resembles *E. kuehniella* from the description, but the plate shows two supplementary lines in the basillary space and another in the middle of the terminal space, the imperfect crossing being replaced by a round dot. This slight difference he is inclined to lay at the door of the artist, and thinks that the species may prove to be identical with *E. kuehniella*, the more particularly as its larval habits are precisely the same. For the present, however, he is content to let the species remain as *E. sericaria* (Scott). This communication we deem of considerable importance, as probably adding a new locality to the so-called Mediterranean Flour Moth, and in view of the fact that the species was known in Australia as early as 1859, as indicating, in case the identity is shown, that the species may be an indigene of that country.

HELIOTHIS ARMIGER IN AUSTRALIA.

According to the March number of the *Agricultural Gazette of New South Wales*, our old friend, *Heliothis armiger*, there called the Maize Moth, has done great damage recently in portions of New South Wales. No mention is made of the ear-feeding habit of the larva, and the principal damage is done by the destruction of the heart of the plant, the larvæ hiding between the coils of the young leaves. The species has long been known in New South Wales, but accounts of damage have been rare.

CUT-WORM DAMAGE TO GRAPES IN CALIFORNIA.

Through the kindness of Mr. J. R. Williams, Weather Bureau Observer at Fresno, Cal., we have been put in possession of particulars concerning a most interesting case of damage to vineyards by two cut-worms in Fresno county this spring. The district surrounding Fresno is essentially a raisin district, and at a number of points the cut-worms have appeared in such extraordinary numbers as entirely to defoliate the vines. Hiding under the surface of the ground during the day, as is their normal habit, they have issued at night, climbed the vines, and eaten off the leaves and young shoots. The specimens forwarded by Mr. Williams show that both species are identical with eastern forms. The most abundant is *Agrotis messoria*—the Dark-sided Cut-worm—a widespread species which has been locally known in New York state as the "onion cut-worm." The Variegated Cut-worm (*Agrotis saucia*) occurs in lesser numbers. The first of these species we have previously received from California through Mr. Koebele, but the latter we have not before known as an injurious species on the Pacific Coast. Mr. Williams informs us that ashes, sulphur, lime, and Paris green in powder have been used to no effect, but that the use of Paris green in solution has resulted successfully. Inasmuch as the worms are obliged

to feed upon the vines in order to get the poisonous dose where Paris green is sprayed upon the plants themselves, we have recommended the poison-trap system, urging that grass or alfàlfa, sprinkled with an arsenical solution, be scattered at the bases of the vines.

ON THE TRANSFORMATIONS OF THE SATURNIIDÆ.

Dr. A. S. Packard has recently published in the Proceedings of the American Academy of Arts and Sciences [New Series, Vol. XX (?), pp. 55–92], a paper entitled "Studies on the Transformations of Moths of the Family Saturniidæ," in which he gives the results of a series of most careful examinations of the different larval stages of these insects. He believes from his studies of the larva that the family originated from some spiny group, undergoing a change in shape from a rather long, slender form to a thick, heavy body with a thin skin, perhaps as a result of an unusually stationary mode of life. He shows also that the adults have apparently undergone a process of degeneration, as seen in the total or partial atrophy of the maxillæ, and in the loss of the veins in the large but weak wings. The loss of strength of flight, however, he thinks is somewhat compensated by the remarkable development of the olfactory organs or antennæ. He believes the family to be a closed type, unless perhaps the Cochliopodidæ have descended from it. It appears to represent a side branch of the Bombycine tree, which grew apart late in geological history and reached a marked degree of modification, resulting in adaptive characters not transmitted to later forms. The type is probably Miocene-Tertiary which has lingered on in eastern America and eastern Asia, as well as in Africa, while it has become nearly extinct on the Pacific shores of North and South America. He describes most fully the larval stages of each of our common forms, summarizing at the end of each description under different heads the congenital characters and the evolution of later adaptational features.

THE TITYRUS BUTTERFLY ATTRACTED TO LIGHT.

In Excursus 10 of Scudder's "Butterflies of New England" it is stated that while several butterflies have been found attracted to electric lights since their general use in the country, but two instances are known of the attraction of butterflies to ordinary lights at night. These are *Apatura celtis*, reported by Miss Murtfeldt, and *Anosia plexippus*, recorded by Dr. Merriam. At 9 o'clock on the evening of June 6, after a long continued rain, weather sultry, a handsome fresh male of *Eudamus tityrus* entered my study through the open window. It fluttered about with a heavy lumbering flight, quite unlike its usual active darting motion in the sunlight, and was evidently strongly attracted by the white curtains, upon one of which it finally perched and passed the night. The adjoining garden contains several old Black Locust trees, upon one of which it had probably fed in the larval

state. We believe that this is the first record of a nocturnal flight of this insect. The nearest locust tree is some fifty feet from the window.—[L. O. H.

A BANANA BORER IN TRINIDAD.

We notice an interesting article in the Journal of the Trinidad Field Naturalists' Club for February, 1893, by Mr. Thomas I. Potter, who has discovered that the larva of *Castnia licus* does serious damage to the Banana plant in Trinidad by entering at the base of the sucker and almost on a level with the soil and boring upwards almost into the heart of the plant. The larva is three inches long when full-grown, with light brown head, darker mandibles, and whitish body. Nothing can save the plant, according to Mr. Potter, when it has been affected for some time. The eggs are laid singly inside the dry and withered stalk at the base of the sucker. The insect is known locally as the "cane sucker." The species is not known as a pest in Florida, but with the extension of banana growing may make itself known.

THE SUPPOSED SPREAD OF THE GYPSY MOTH.

The director of the field work of the Gypsy Moth commission, Mr. E. H. Forbush, has recently written a letter for publication in the agricultural journals of New England, in which the statement is made that, notwithstanding all the statements to the contrary (and we have noticed one or two of them in INSECT LIFE), the Gypsy Moth has not been seen outside the region where it was found in 1891. During December last Mr. Forbush had an average of nearly thirty men at work searching for the eggs.

SOUTHERN RANGE OF THE COLORADO POTATO-BEETLE.

The Colorado Potato-beetle, as we have already noticed, has made its appearance in the northern part of Alabama in alarming numbers. While it may be that this is but a repetition of the occasional accidental introduction of this pest, which has frequently occurred of late years, and while it may die out after a season or two, the Department of Agriculture of Alabama has taken a very proper step in issuing a little bulletin entitled "Mode of destroying the Colorado Potato-beetle and Harlequin Cabbage-bug," which was published during April.

THE SPOTTED BEAN BEETLE.

Epilachna corrupta, a near relative of the so-called Pumpkin Beetle of the east, does a good deal of damage to the bean crop in the southwest. We have previously referred to this insect and its damage to the bean crop in New Mexico on the authority of our old correspondent, Judge J. F. Wielandy, and now notice a rather extended article in *The Prairie Farmer*, with a large illustration showing the different stages

of the insect and the damage which it does by gnawing the bean pods, The beetles not only destroy the bean pods, but feed also upon the leaves, and the larvæ do the same. The remedy to be used is Paris green or London purple in watery solution. The beetles of this genus Epilachna are anomalous in the vegetable-feeding habit, since all other ladybirds are, in the larval state at least, predaceous. The eastern species, *Epilachna borealis*, is treated by Mr. S. H. Scudder in a short article in the Twenty-third Annual Report of the Entomological Society of Ontario, published at Toronto the present spring.

THE PALM WEEVIL IN BRITISH HONDURAS.

We have published one or two short notes in the pages of INSECT LIFE on the subject of the ravages of *Rhynchophorus palmarum* on the Cocoanut Palm in Central America and the West Indies, and are greatly pleased to notice that Mr. W. F. H. Blandford, in the February-March number of the *Kew Bulletin*, has published an elaborate paper upon this injurious insect. The article was called forth by a government investigation which was started in British Honduras, the commissioners having forwarded specimens to England and solicited information from the experts at the Kew Gardens. A closely allied species, *Rhynchophorus cruentatus*, feeds normally upon the Palmetto (*Sabal serrulata*) in the Gulf States, and with the growth of the cocoanut palm industry in parts of Florida it is not unlikely that damage from *R. palmarum* will occur. Some attention is paid in Mr. Blandford's article to the other insects affecting the Palm, but only incidentally. No new points in the life-history have been brought out, but a careful consideration is given to the question of remedies; and the author's main article is followed by a short bibliography, together with careful descriptions of the different stages of the Palm Weevil, and the whole article is illustrated by two excellent lithographic plates, the one showing the larva, pupa, pupa-cell, and adult of *R. palmarum* and the other figuring *Rhina barbirostris* Fab., *Rhina nigra* Dr., *Megasoma elephas* Fabr., and *Œcodoma mexicana* Smith.

Under the head of methods of treatment, Mr. Blandford recommends care in the choice of sites for new plantations, thorough drainage, wide planting, and the destruction of felled trees and stumps. In the choice of a site, undue proximity to a cohoon ridge should be avoided. The trees should be left as far as possible in their natural state and unnecessary trimming avoided. All wounds should at once be dressed with tar mixed with fine sand. Holes should be probed with a hooked wire and then plugged with a tuft of fiber dipped in tar. The parts selected for egg-laying may be plastered with lime wash, to which may be added a small quantity of Paris green. Capture of the adult weevils seems to be practicable. They are attracted in great numbers to the fermenting sap of felled palms or to the split Cabbage Palm, and may then be caught by hand and killed with boiling water.

It has been suggested that the stumps of split Cabbage Palm be sprinkled with a Paris green solution, but no experiments have been tried to ascertain whether the application of the poison will vitiate the attractiveness of the bait. It seems to us, however, that this will probably prove a fairly satisfactory remedy. Mangoes and other fruit, crushed and allowed to ferment, will also prove suitable bait, and the cutting-down of wild palms in the neighborhood in order to catch the beetles visiting the stumps is also recommended. The latter plan, however, is a little dangerous, since these stumps and logs will become breeding places and will require constant watching. Mr. Blandford in his bibliography has overlooked our short notes on the subject in INSECT LIFE. (See vol. I, p. 14, and vol. IV, pp. 136–137.) Five years ago we recommended the plan of cutting off a palmetto plant, say one foot from the ground, and capturing the beetles on the stump. In Vol. IV we elaborated this plan to some extent in the following words:

> There is, however, a preventive method, and this consists in cutting down or wounding several young trees of any wild species of palm growing in the vicinity of the cocoanut trees. The fermenting sap of the trunks of such trees, as you have yourself seen, attracts the beetles strongly, and a multitude of them can thus easily be captured and killed before they have oviposited. The trunks of the felled trees will soon be filled with the larvæ, and the infested portion should be sawed off and burned before the larvæ have matured. If concerted action on the part of owners of cocoanut trees could be obtained, this method would no doubt materially contribute toward a diminution in the number of the beetles and a consequent lessening of the damage to the cocoanut trees.

ALUM FOR ROSE CHAFERS.

There occasionally appears in the columns of the agricultural press an account of the successful use of an alum solution against the Rose Chafer. We notice, for instance, an article in the *Massachusetts Ploughman* of December 17, 1892, by James W. Gage, of Lowell, Mass., who sprayed his vineyard the previous spring with a solution of alum at the rate of one pound to four gallons of water. The application was made in the evening and the next morning the insects had disappeared. He is not of the opinion that the solution kills them, but that it is distasteful and drives them off. Such articles as these are liable to induce a considerable expense in experimentation on the part of other grape and rose growers and the remedy will be undoubtedly ineffectual where the insects are numerous. Accurate experiments have been made by Prof. J. B. Smith, of New Brunswick, N. J., which are recorded upon page 31 of his bulletin on the Rose Chafer. He found that at a strength of one pound to two gallons of water the mixture was perfectly ineffectual. It was so strong that a white deposit lasting several days was produced upon the plants, but the beetles were not kept off. Specimens of the insects dipped in the mixture were not in the least incommoded.

A MOSQUITO EXTERMINATOR.

The *Indian Medical Record* for March 16 says that a Bombay newspaper calls attention to the virtues of the castor-oil plant as a means of protection against mosquitoes. In Egypt it is planted about houses to drive the insects away. In towns a better plan is to have the growing plants in pots, and bring them into the house for a day or two at a time, but they must not be kept too long in the shade, for the *Palma christi* is a sun-loving plant. A writer is cited as saying that the mosquitoes are killed by a poison that they find on the lower side of the leaf, but it is stated that if a dozen leaves are placed about a room that swarms with mosquitoes they will disappear without leaving any dead ones lying about.—[N. Y. MED. JOURN., 1893, No. 10, p. 446.

THE HORN FLY IN CANADA.

Mr. A. F. Winn, in No. 5, Vol. v, of the *Canadian Record of Science*, publishes a short article on the subject of the Horn Fly, in which he compiles an interesting account of the habits and life-history of the species and publishes a well written letter from Mr. W. A. Oswald, of Belleriviere, Quebec, concerning the first appearance of the insect in his locality, which is about 20 miles from Montreal. It seems that the Horn Fly was first observed about the middle of July, 1892, although the probabilities are that it occurred in small numbers in that locality in 1891, since we have invariably found this to be the case on our side of the border. Young cattle seem to suffer more than older animals, and train oil was found to keep the flies away for from five to six days.

RECENT STUDIES UPON LACHNIDIUM ACRIDIORUM Gd.

Upon page 151 of Volume IV we reviewed the investigations of MM. Künckel and Langlois of the cryptogamic disease which sometimes attacks the Migratory Locust (*Schistocerca peregrina* Ol.) of Africa, giving the authors' conclusion that the prospect of exterminating the Migratory Locust in Algeria by means of this disease was not encouraging. The fungus in question was determined by M. A. Giard as *Lachnidium acridiorum* n. sp. We have received a pamphlet extracted from the *Révue Générale de Botanique*, Tome IV, 1892, p. 449, in which Prof. Giard gives the results of his latest studies of this question. It appears that the most extravagant statements have been made in the public press as to the usefulness of the disease in exterminating locusts, one writer declaring that the solution of the problem has been found not only for locusts, but probably for all injurious insects. M. Giard deplores these unfounded statements, since his investigations, as well as those of MM. Künckel and Langlois, show conclusively that the fungus is a purely superficial and not very malignant malady; that contamination takes place with difficulty between diseased and healthy individuals, even when placed in the same receptacle and uniting sexually;

and that it attacks particularly those individuals which have reached the end of their evolution. It does not penetrate the tissues like Entomophthora and Isaria, but vegetates superficially and only becomes dangerous to the insect when it invades the tracheæ and causes asphixiation. Moreover, Lachnidium can only develop in certain conditions of humidity, which are rarely present in Algeria, and it is not proven, so far, that the cryptogam attacks the eggs of the Migratory Locust, even when these have been laid by infested parents. The premature glorification of Lachnidium as a specific for the Migratory Locust is not unlike the recent proposition of certain optimistic Californians to cease the spraying and fumigation of their citrus orchards for the Red Scale in the expectation that the new Australian parasites would do the work more effectually and cheaply. As M. Giard pointedly remarks, "In moments of public calamity, unfortunately, the people who suffer need no invitation to have recourse to the counsels of charlatans."

GALL-MAKING COCCIDÆ.

We have just received from Mr. Walter W. Froggatt, of the Technological Museum of Sydney, New South Wales, a brief but extremely interesting paper entitled "Notes on the family Brachyscelidæ, with some account of their Parasites and Descriptions of New Species," extracted from Vol. VII of the Proceedings of the Linnæan Society of New South Wales. These remarkable scale-insects form curicus woody galls on plants of the genus Eucalyptus. The male galls are small tube-like excrescences, with the apex dilated into a bell or cup like form, generally bright red or yellow, and are always found upon the leaves or very slender twigs, except when they spring direct from the female galls. The female is usually cylindrical and grub-like in appearance, enveloped in a waxy secretion. She lies in a fleshy gall sometimes a quarter of an inch thick, the head downward and the anal end pointing outward. The active, two-winged adult males emerge from their smaller galls and by means of their slender pointed abdomen impregnate the imprisoned females through an apical orifice in the female galls. The young escape from an egg-mass within the body of the female and emerge through an opening in the gall, burying themselves in the bark or leaves and causing new gall growths around them. Mr. Froggatt is of the opinion that parthenogenesis occurs with this family, since he has found clusters of active larvæ in the same gall with the perfect and evidently unimpregnated female. Mr. Froggatt redescribes in the true genus Brachyscelis all the species described by Mr. H. L. Schrader in the Transactions of the Entomological Society of New South Wales for 1862, and adds eight new species from material obtained from various parts of Australia. These peculiar insects are of some economic importance, since, though they do not cause the death of the Eucalyptus, they stunt the young trees in Eucalyptus plantations and render them weak and unfit for transplanting.

THE EGYPTIAN ICERYA IN INDIA.

Mr. Robert Newstead, of the Grosvenor Museum, of Chester, England, a well known student of the Coccidæ, writes us that he has recently received from Miss L. E. Tomlin, of Nungumbalcum, Madras, a number of specimens of *Icerya ægyptiacum*, which has hitherto been known only from Alexandria and Cairo, Egypt. The specimens when received by Mr. Newstead were swarming with minute parasites, specimens of which he forwarded to us. The finding of this scale-insect in India, and particularly the fact that it is so extensively parasitized there, creates a reasonable possibility that it is indigenous to that country, and we examined the parasites with great interest only to find that they belong to the genus Tetrastichus, all the species of which, so far as we know, are secondary in their habits. The presence of this insect, however, argues the existence of an important primary parasite in India, and we have written to our correspondent there, Mr. E. C. Cotes, of the Indian Museum, Calcutta, to search for the latter, and have also asked Mr. Newstead to request Miss Tomlin to do the same. No parasites of the Egyptian Icerya have been discovered in Egypt, and this fact partially accounts for the extraordinary spread of the species in the gardens of Alexandria and Cairo.

CARBON BISULPHIDE FOR HEN LICE.

A new use for the bisulphide of carbon has been pointed out by Dr. Schneider in the *Journal de l'Agriculture*, of Paris, of recent date. Dr. Schneider recommends tying a few small bottles of bisulphide of carbon to the perches in the henhouse, the bottles being unstoppered and the liquid allowed to evaporate. The hens roost over the bottles, and the vapor of the bisulphide kills the lice. The recommendation is founded upon careful experiment, as the following extract will show:

> The very next day after using it I was agreeably surprised to find that the enemy had left, leaving none but dead and dying behind, and on the following day not a single living insect was to be found, while my birds were sitting quietly on the roosts, enjoying an unwontedly peaceful repose. This lasted for twelve days, till the sulphide had evaporated. Twenty-four hours later a fresh invasion of lice had put in an appearance under the wings of the birds in the warmest portions of the house, where there were no currents of air. I replenished the supply of sulphide, and the next morning only a few of these were remaining. The next morning every trace of vermin had disappeared. Since that time I have personally made a great number of further trials with the sulphide, with immediate and absolute success. I should recommend the sulphide of carbon to be put in small medicine vials hung about the pigeon house or poultry roost. When it has about three parts evaporated the remainder will have acquired a yellowish tinge, and no longer acts so completely as before, but if it be shaken up afresh it will suffice to keep the enemy at a distance.

THE LONG SCALE NOT BROUGHT FROM MEXICO TO CALIFORNIA.

On page 281 of the last number of INSECT LIFE, under the caption "Introduction of the Long Scale into California," we quoted from the

California *Fruit Grower* of December 10, 1892, the statement that 22 carloads of Mexican oranges infested by *Mytilaspis gloverii* had been imported into California at Los Angeles, rather emphasizing the indignation of the editor of the journal over the supposed negligence of the quarantine officers in allowing this importation. We recently received a letter from Mr. John Scott, Horticultural Commissioner of Los Angeles county, who states that the item upon which we based our note was incorrect. Mr. Scott states that not a single carload of Mexican oranges was brought to Los Angeles last year. A few boxes were sent from San Francisco, which were at once returned and not a single orange of this shipment was sold in the city of Los Angeles. We are very glad to make this correction, but the onus of the misstatement, if misstatement there was, lies upon the California *Fruit Grower*.

AN ENEMY OF THE OYSTER-SHELL BARK-LOUSE OF THE APPLE.

We have received from M. J. Lignières, assistant professor at the veterinary school at Alfort, France, a pamphlet extracted from the Mémoires de la Société Zoologique de France, 1893, in which he records the first discovery in Europe of *Tyroglyphus malus* (Shimer) in the scales of the Oyster-shell Bark-louse, *Mytilaspis pomorum*. In this country this species has usually been considered an enemy of the Oyster-shell Bark-louse, but the author's experiments, which have evidently been very carefully conducted, seem to prove that it is not. He finds that it does not feed upon the eggs of Mytilaspis, as supposed, nor does it suck the juices of the tree, but lives only upon the cast skins and egg shells of the bark-louse, and upon these only when they are somewhat moist. A full redescription of the species is given, with good outline figures and a more detailed anatomical account of certain parts of the body.

In the second part of the pamphlet, however, M. Lignières describes a new Acarian which is, he states, a true enemy of *Mytilaspis pomorum*. From its striking resemblance to the Sarcoptidæ he proposes for it the generic name *Hemisarcoptes*, with the specific name *coccisugus*. The species is described and figured, and a statement given of the differences in mode of life between it and Tyroglyphus. It attacks the eggs of Mytilaspis and is the most formidable enemy of the latter.

AN ARTICLE ON SCALE-INSECTS.

Mr. T. D. A. Cockerell, in the *Agricultural Record*, the official journal of the Central Agricultural Board of Trinidad for December, 1892, publishes a general article on the subject of Coccidæ, or scale-insects, which possesses more than passing interest. He defines the group, discusses their destructiveness, the methods of destroying them, the natural enemies, and how they are spread by human means. He considers that while those who have attributed the death of the Cocoa Palm to scale-insects have probably overestimated the influence of the

insects, in general their damage is frequently under-estimated. In case of small plants death may speedily ensue, and in the case of larger ones the vitality and consequent fruit yield are greatly reduced. To the objection that a drain on the fruit production is not necessarily harmful and that we are obliged to check exuberant growth by pruning, he replies that the purpose of pruning is not so much to check the energies of the plant as to divert them to fruit and flowers, while the Coccidæ attack not only the fruiting branches but the fruit itself, injuring the very parts it is desired to protect. Of the fourteen species which attack Citrus plants in the United States, he finds that eleven occur in Jamaica.

NORTH AMERICAN NEUROPTERA.

A most useful paper has just reached us in the shape of a Synopsis, Catalogue, and Bibliography of the Neuropteroid Insects of temperate North America, by Nathan Banks. It is an author's extra from the Transactions of the American Entomological Society, Vol. XIX, pp. 327–373. The key to families and genera will be found of considerable value in separating the forms of these insects, which have been little studied in this country except by Dr. Hagen, the forced cessation of whose labors will prevent the publication of a comprehensive work at his hands. The catalogue of species which follows is unexpectedly extensive and the bibliography seems full and accurate. In the grouping of the forms into super-orders, orders, sub-orders, and super-families, Mr. Banks gives expression to somewhat radical views, which may or may not be warranted, but which seem somewhat presumptuous following the careful study and philosophic treatment which the subject has received at the hands of such masters as Brauer and Packard. Thus the Plecoptera and the Corrodentia are made sub-orders of the Platyptera, the Plectoptera and Odonata sub-orders of the so-called order Subulicornia, while the Mecaptera are made a sub-order of the Neuroptera, on the same plane with the sub-order Planipennia, in which are included the super-families Sialina and Megaloptera. The whole group of Neuropteroid forms is made a super-order, Phyloptera. It is to be regretted that in proposing so radical a change in the classification of the higher groups, Mr. Banks has not stated more at length the reasons which have led him to adopt this course.

NEW ENTOMOLOGICAL PUBLICATION.

The recently-organized New York Entomological Society has published the first number of its Journal, which reached us early in April of the present year. It covers 48 pages of interesting matter, and is illustrated by a full-page plate. The appearance of the Journal is excellent, and the contributors include such well-known entomological writers as Mrs. Slosson, Dr. Packard, Mr. Angell, Mrs. Treat, Mr. Charles Palm, Messrs. Neumoegen and Dyar, Mr. Beutenmüller, and

Mr. William T. Davis. Mr. Beutenmüller is the editor, and is assisted by a publication committee, consisting of Messrs. Ottomar Dietz, Charles Palm, and Berthold Neumoegen. The most important article in the number is Dr. Packard's "Attempt at a New Classification of the Bombycine Moths," which he divides into fourteen families, the most revolutionary step in the proposed classification being the transfer of the old family Zygaenidæ as a whole to the Bombycine series. Mrs. Treat's "Some Injurious Insects of Orchard and Garden" is the only article of immediate economic importance, and consists of a series of local observations on the insect pests of the vicinity of Vineland, N. J.

ENTOMOLOGICAL SOCIETY OF ONTARIO.

The twenty-third annual report of this enterprising society has just reached us. It covers the year 1892, and is, as usual, published by order of the legislative assembly. It contains a number of most interesting articles, some of which have already been published in the *Canadian Entomologist*, while others are original here. Mr. James Fletcher's article upon the Horn Fly we have already noticed in its form as a bulletin of the Canadian Experiment Stations. The same author publishes an account of the clothes moths found in Canada, drawing largely from our article upon the same subject in a previous number of INSECT LIFE, but at the same time adding a number of interesting observations of his own. Perhaps the most striking article in the number is Mr. Scudder's "Songs of our Grasshoppers and Crickets," in which he passes in review what is known of our American species in this particular, beginning with the crickets and treating the species in systematic order. The songs are reduced to a musical notation, which is done simply for the purpose of illustrating intervals, since the pitch does not vary and, in fact, does not seem to have been determined. Mr. Scudder adopts arbitrarily the system of representing a second by a bar, a quarter-second by a quarter-note, a thirty-second of a second by a thirty-second note, etc. Musicians will thank him for the introduction of a new form of rest which we may describe as an obliquely truncate parallelogram and which indicates silence throughout the remainder of the measure. The subject is an interesting one and has been studied by Mr. Scudder for many years, his early contributions having been published in the *American Naturalist* a number of years ago. The annual address of the president, Rev. Dr. C. J. S. Bethune, covers some seven pages, and consists of an interesting review of the entomological events of the season.

A NEW PATENTED INSECTICIDE.

Among the many insecticides which are patented during the year is occasionally one which attracts considerable attention. The so-called "Brown's Insect Exterminator" as noticed in the *California Fruit*

Grower of November 19, 1892, was highly recommended by several experienced fruit growers at the State Fruit Growers' Convention at San José, and it was stated that the Commissioners of Santa Cruz County intend to use it extensively the coming season.

WHY INSECTS INFEST PLANTS.

Mr. John Saul, of Washington, D. C., read a paper before the Society of American Florists at Washington last summer. He shows that any check in the vitality of a given plant, either through unsuitable or undrained soil, too much or too little water, want of pure air or sunshine, or one or more of many other causes, is followed by the attacks of insects. He cites especially greenhouse plants which suffer from scale-insects. He believes it possible to grow plants and crops of such health and vigor that insects will not seriously damage them. Interesting instances in support of this rather old, but none the less plausible, and to a certain extent sound opinion are given; but the author's idea that the weakly condition of the plants generates the scale-insects is of course totally unjustified.

INSECT LEGISLATION IN MASSACHUSETTS.

According to the *New England Farmer* of April 22, the legislature of Massachusetts has enacted a law relative to the "extermination" of injurious insects. It is evident from the text, which we reproduce in full, that the law is directed particularly against the Gypsy Moth and Tent Caterpillar, although these insects are not specifically mentioned. The following is a copy:

SECTION 1. Cities and towns shall raise annually by taxation and appropriate such a sum of money as they may deem necessary, to be expended under the direction of the mayor and aldermen in cities and the selectmen in towns, in exterminating insect pests within the limits of the highways in their respective cities and towns, and the removal from said highways of all trees and shrubs upon which such pests naturally breed: *Provided, however,* That where the owner or lessee of real estate abutting on the highway shall annually exterminate all insect pests from the trees and shrubs along the highway where said real estate abuts thereon, such trees and shrubs shall be exempt from the provisions of this act.

SEC. 2. This act shall take effect in any city when accepted by the city council, and in any town when accepted at a legal town meeting called for that purpose.

BORERS IN FIG TREES.

The New Orleans *Times-Democrat* is authority for the statement that thousands of fig trees are being destroyed in the neighborhood of New Orleans by "the flat-headed tree borer." The species effecting all this damage is not known to us, but is possibly *Ptychodes vittatus*, a large Longicorn, the larva of which is said to girdle the twigs of fig trees. A number of remedies are recommended, but some sort of wash applied to the bark at the time that the female beetle deposits her eggs will be the most efficient. Such a wash as is used to prevent the attacks

of similar borers—namely, a strong soap solution to which has been added a small quantity of crude carbolic acid or a little Paris green—would, if applied at the right time, greatly reduce the damage.

FOOD OF TARANTULA IN CONFINEMENT.

Our old friend, Dr. J. M. Shaffer, of Keokuk, Iowa, has recently published in a local paper an account of the feeding habits of a "Tarantula" which was found at Keokuk in the fall of 1890 in a bunch of bananas. This large Theraphosid spider was kept by Dr. Shaffer and some interesting feeding experiments were followed out between the above date and October 20th, when the spider became torpid and was subsequently placed in alcohol. Dr. Shaffer found among the many things he experimented with that the spider fed upon Cockroaches, larvæ of *Apatela americana*, Dog Day Harvest Fly (*Cicada canicularis*), Red-legged Grasshopper (*Caloptenus femur rubrum*), Horse Fly (*Tabanus atratus*). The following were also placed in the box, but were not touched: Live mouse, raw beef, Colorado Potato-beetle, Cecropia caterpillar, Tent-caterpillar (*Clisiocampa americana*), larvæ of the Interrogation Butterfly (*Grapta interrogationis*), Five-spotted Sphinx (*Macrosila cingulata*), Crickets, Carolina Locust (*Dissosteira carolina*). The box in which Dr. Shaffer kept the specimen, and in which it made itself quite at home, was 8 by 12 by 16 inches and had a glass cover. When he placed in the mouse it did not seem to be in the least afraid of the spider, but ate corn and cheese, and eventually gnawed its way out.

ENTOMOLOGICAL SOCIETY OF WASHINGTON.

May 4, 1893.—A paper by Prof. C. H. T. Townsend entitled "Notes on the Coruco, a Hemipterous insect which infests poultry in southern New Mexico," was read by Mr. Schwarz. The author described the habits of the species which he identified as *Cimex inodora* Dugés and added a description of the nymph. Discussed by Messrs. Ashmead, Schwarz, and C. W. Johnson. Mr. Schwarz read descriptions of *Anchonus floridanus* and *Loganius ficus*, both representing genera new to the North American fauna. The following notes by Mr. Wm. H. Patton were read: Discovery of the male of *Pterochilus 5-fasciatus* Say; *Zethus aztecus* in Florida; Notes on Wasps No. 1. Mr. Ashmead presented a "Synopsis of the North American species of Toxoneura Say." Specimens were exhibited by Messrs. Heidemann and Schwarz.

June 1, 1893.—D. MacCuaig was elected an active member and H. H. Goodell, of Amherst, Mass., and A. L. Montandon, of Bucarest, Roumania, corresponding members. Dr. Marx read a paper entitled "Continuation of the life history of the Whip-tail Scorpion" in which he described the habits and growth of a specimen of *Thelyphonus giganteus* during the second year of its confinement. Discussed by Messrs. Schwarz, Marx, Howard, and Riley. Mr. Ashmead presented certain "Notes on the family Pachyllommatoidea" of Foerster. He gave a historical review of the views of different authors as to systematic position of these insects and concluded that the group is a subfamily of the Braconidæ. He erected a new genus Eupachylomma to contain two new North American species.

Mr. Frank Benton presented some "Notes on the Death's Head Moth in relation to Honey Bees" describing his personal observations with this moth in south Europe

and Syria and exhibiting specimens which had been killed by bees. He does not consider that it is a serious enemy to the honey bee. Discussed by Messrs. Stiles, Schwarz, Riley, Gill, Chittenden, Marx, and Howard. Prof. Riley exhibited a series of specimens of Lachnosterna, showing several which had exhibited a remarkable longevity when kept in an old weak cyanide bottle containing some moist blotting paper. Beetles placed in similar bottles containing no cyanide died in three days, while one of the former lived for thirty days. He found that there was no perfect succession of species this spring. Individuals of *L. hirta* were as abundant June 1 as they were May 1. Dr. Riley also referred to the hibernation of the Coccidæ and stated that he had recently ascertained that many forms hibernate not only in the egg and full grown condition but practically in all stages. Kerosene can not be used successfully during the winter upon full grown females of the Diaspinæ, but is effective upon the young. He spoke of the extraordinary traveling powers of the young of *Chionaspis euonymi* and mentioned the effect of the severe cold of last winter upon the Diaspinæ, stating that *Aspidiotus perniciosus* had been almost exterminated on the maple trees of this city. These several communications were discussed by Messrs. Doran, Schwarz, Marx, Howard, Ashmead, and Benton. Specimens were exhibited by Mr. Schwarz.

L. O. HOWARD,
Recording Secretary pro tem.

INDEX TO ILLUSTRATIONS.

ERRATA.

Page 18, thirteenth line from bottom, for "*trivittatus*" read *vittatus.*
Page 33, last line, for "*globularis*" read *globulus.*
Page 35, under CHRYSOMELIDÆ, first line of second paragraph, for "*Artimisia*" read *Artemisia.*
Page 38, under COLEOPTERA, first line of third paragraph, for "*Thryncopyge*" read *Thyrincopyge.*
Page 39, line 31, under *Diabrotica tenella,* for "*peas*" read *pears.*
Page 53, third line, for "*7*" read *14.*
Page 62, second line from bottom of first paragraph, for "*reprinted*" read *referred to.*
Page 63, line 2, for "*Sixth*" read *Fourth Annual.*
Page 89, first article, fourth line from bottom, for "*or*" read *on.*
Page 135, line 18, from bottom, for "*albicornus*" read *albicornis.*
Page 139, third line of second note, for "*cardinallis*" read *cardinalis.*
Page 155, third line from bottom, for "*Dorchaschema*" read *Dorcaschema.*
Page 159, second line of footnote, for ♂ read ♀♀; third line of do., for ♂ read ♀; near middle of page (4), for "*Cavaliers, Pen.*" read *Cavaliers.*
Page 160, line 3, for "*Orthesia*" read *Orthezia;* line 15 (13), for "*green*" read *Green;* line 16 from bottom (18), for "*Merium*" read *Nerium.*
Page 165, line 25, for "*tosata*" read *tesota.*
Page 166, fifth line from bottom, for "*Canavalbia*" read *Canavalia.*
Page 176, in explanation of figures, for "*natural size*" read *enlarged.*
Page 182, line 3, for "*20*" read *8;* line 10, for "*June*" read *May;* line 18, for "*wolfii*" read *wolffii.*
Page 204, fourth line from end of "Notes from Correspondents," for "*glabberimum*" read *glaberrimum.*
Page 244, for "*Fig. 25*" read *Fig. 34a.*
Page 254, footnote, for "*1892*" read *1893.*
Page 259, for "*irridescens,*" read *iridescens.*
Page 286, note on Manna Scale, fifth line, for "*extent*" read *extension;* last line, for "*section*" read *secretion.*
Page 288, second paragraph, fourth line, for "*Deridrotettir*" read *Dendrotettix.*

AUTHORS' INDEX.

PLANT INDEX.

Q.

R.

GENERAL INDEX.

D.

F.

I.

L.

LIST OF THE PERSONS ENGAGED IN GOVERNMENT ENTOMOLOGICAL WORK.

The following list embraces those now engaged in Government entomological work. The force of the Division of Entomology is more or less inconstant, as it consists of both permanent and temporary employés. Illustrations to this Bulletin, where not otherwise stated, are drawn by Miss Lillie Sullivan, under supervision.

DIVISION OF ENTOMOLOGY, U. S. DEPARTMENT OF AGRICULTURE.

Entomologist: C. V. Riley.

Office Staff: L. O. Howard, First Assistant; E. A. Schwarz, Th. Pergande, C. L. Marlatt, F. H. Chittenden, W. H. Ashmead, Assistants.

Field Agents: Herbert Osborn, Ames, Iowa; Lawrence Bruner, Lincoln, Nebr.; D. W. Coquillett, Los Angeles, Cal.; Albert Koebele, Alameda, Cal.; Frank Benton, Detroit, Mich.

DEPARTMENT OF INSECTS, U. S. NATIONAL MUSEUM.

Honorary Curator: C. V. Riley.

Aid: Martin L. Linell.

To bibliographers: Editorial or unsigned articles or notes should be accredited to Riley and Howard, where it is desired to give personal credit.

DATES OF ISSUANCE OF THE NUMBERS OF INSECT LIFE, VOLUME V.

No. 1 issued September 27, 1892.
No. 2 issued November 21, 1892.
No. 3 issued January 27, 1893.
No. 4 issued May 4, 1893.
No. 5 issued July, 1893.

LIST OF THE PERSONS ENGAGED IN GOVERNMENT ENTOMOLOGICAL WORK.

The following list embraces those now engaged in Government entomological work. The force of the Division of Entomology is more or less inconstant, as it consists of both permanent and temporary employés. Illustrations to this Bulletin, where not otherwise stated, are drawn by Miss Lillie Sullivan, under supervision.

DIVISION OF ENTOMOLOGY, U. S. DEPARTMENT OF AGRICULTURE.

Entomologist: C. V. Riley.

Office Staff: L. O. Howard, First Assistant; E. A. Schwarz, Th. Pergande, C. L. Marlatt, F. H. Chittenden, W. H. Ashmead, R. S. Lull, Assistants.

Field Agents: Herbert Osborn, Ames, Iowa; Lawrence Bruner, Lincoln, Nebr.; D. W. Coquillett, Los Angeles, Cal.; Albert Koebele, Alameda, Cal.; Frank Benton, Detroit, Mich.

DEPARTMENT OF INSECTS, U. S. NATIONAL MUSEUM.

Honorary Curator: C. V. Riley.

Aid: Martin L. Linell.

To bibliographers: Editorial or unsigned articles or notes should be accredited to Riley and Howard, where it is desired to give personal credit.

U. S. DEPARTMENT OF AGRICULTURE.

DIVISION OF ENTOMOLOGY.

PERIODICAL BULLETIN.

November, 1893, to August, 1894.

INSECT LIFE.

Vol. VI.

DEVOTED TO THE ECONOMY AND LIFE-HABITS OF INSECTS, ESPECIALLY IN THEIR RELATIONS TO AGRICULTURE.

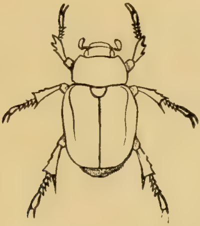
EDITED BY

C. V. RILEY, Entomologist,

AND

L. O. HOWARD, First Assistant,

WITH THE ASSISTANCE OF OTHER MEMBERS OF THE DIVISIONAL FORCE.



[PUBLISHED BY AUTHORITY OF THE SECRETARY OF AGRICULTURE.]

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1894.

TABLE OF CONTENTS.

CONTENTS OF No. 1.

CONTENTS OF No. 2.

CONTENTS OF No. 3.

CONTENTS OF No. 4.

CONTENTS OF No. 5.

DIVISION OF ENTOMOLOGY, U. S. DEPARTMENT OF AGRICULTURE.

Entomologist: C. V. Riley.

Office Staff: L. O. Howard, First Assistant; E. A. Schwarz, Th. Pergande, C. L. Marlatt, F. H. Chittenden, W. H. Ashmead, D. W. Coquillett, Frank Benton, H. G. Hubbard, Assistants; Miss L. Sullivan, Artist.

DEPARTMENT OF INSECTS, U. S. NATIONAL MUSEUM.

Honorary Curator: C. V. Riley.

Assistant: Martin L. Linell.

To Bibliographers: Editorial or unsigned articles or notes should be accredited to Riley and Howard, where it is desired to give personal credit.

Concerning Illustrations: All illustrations in Insect Life are drawn by Miss Lillie Sullivan, under supervision, unless otherwise expressly stated.

DATES OF ISSUANCE OF THE NUMBERS OF INSECT LIFE, VOLUME VI.

No. 1 issued November 3, 1893.
No. 2 issued December 8, 1893.
No. 3 issued February 28, 1894.
No. 4 issued May 11, 1894.
No. 5 issued August, 1894.

U. S. DEPARTMENT OF AGRICULTURE.

DIVISION OF ENTOMOLOGY.

PERIODICAL BULLETIN. Issued November, 1893.

Vol. VI. No. 1.

INSECT LIFE.

DEVOTED TO THE ECONOMY AND LIFE-HABITS OF INSECTS, ESPECIALLY IN THEIR RELATIONS TO AGRICULTURE.

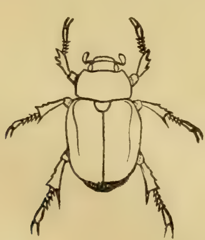
EDITED BY

C. V. RILEY, Entomologist,

AND

L. O. HOWARD, First Assistant,

WITH THE ASSISTANCE OF OTHER MEMBERS OF THE DIVISIONAL FORCE.



[PUBLISHED BY AUTHORITY OF THE SECRETARY OF AGRICULTURE.]

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1893.

CONTENTS.

SPECIAL NOTES.

Forest and Shade Tree Enemies in West Virginia.—Bulletins 31 and 32 of the West Virginia Agricultural Experiment Station, by Mr. A. D. Hopkins, published in April and May, 1893, respectively, contain much matter of interest to the student of forest insects. Bulletin 31 is a catalogue of West Virginia Scolytidæ and their enemies, but it is also something more than a catalogue. It gives rearing records and brief tabular accounts of the habits of 80 species of Scolytidæ and of 88 species of the natural enemies of these destructive beetles. In considering parasites Mr. Hopkins has carefully distinguished between those found simply associated with the supposed host; those which he considers to be primary, and those which he considers to be secondary. Although the records would have been of more value had the reasons for these conclusions been given, the list nevertheless marks an advance in this direction. It is interesting to note that Mr. Hopkins has reared 8 distinct parasites of *Scolytus rugulosus*, and a further remarkable observation is recorded in the fact that a Chalcidid of the subfamily Pteromalinæ was reared from the adult of *Pityophthorus minutissimus*, an observation which is without parallel in the whole family Chalcididæ.

Bulletin 32, which comprises a catalogue of the West Virginia forest and shade-tree insects, is naturally more extensive, and covers some 75 pages, giving rearing records of no less than 494 species. The bulletins are well printed upon good quality of paper, but are somewhat marred by the results of inexpert proof-reading.

Orange Insects in Louisiana.—The Louisiana Agricultural Experiment Station at Baton Rouge, La., has published a special bulletin on the subjects of the Orange and other Citrus fruits from seed to market, with insects beneficial and injurious, with remedies for the latter, by Prof. W. C. Stubbs, Director of the Station, and Prof. H. A. Morgan, Entomologist. The bulletin fills a great want, since we have no modern work in English on the cultivation of the Orange. Prof. Morgan's contribution to the bulletin is partly a repetition of our publications on the scale insects affecting Citrus trees in Florida and California, but is of great interest as indicating the particular insect fauna of the plants

7902—No. 1——1

in the intermediate locality of Louisiana. Besides, the report contains many original observations by the author and a few new illustrations. Some account is also given of the scale insects which are liable to be imported into Louisiana. Original colored plates are given, illustrating the Oyster-shell Bark-louse of the Apple, the Purple Scale, the San José Scale, the Long Scale, the Yellow Scale, the Apricot Scale, and the Florida and California Red Scales, as well as the smut fungus, the Florida Ceroplastes, the Orange Mealy-wing, the Chaff Scale, and the Orange Chionaspis.

Bulletin 7 of the Washington Experiment Station.—Mr. Charles V. Piper, the newly appointed Entomologist to the Agricultural Experiment Station at Pullman, Wash., in Bulletin 7 publishes his first entomological information. He treats of the Pea Weevil and the Cottony Maple-scale, the accounts being mainly compiled. The Cottony Maple-scale, which he determines as *Pulvinaria innumerabilis*, is stated to occur upon Currant, Gooseberry, Plum, Pear, Hawthorn, Mountain Ash, Lombardy Poplar, Weeping Willow, Flowering Currant, the Upland Willow, and Swamp Willow. It does not occur upon either of the native maple trees, which are abundantly planted as shade and ornamental trees in that State. This fact in itself should have suggested to Mr. Piper that the Northwestern species differs from that of the East, as it really does, since numerous specimens received from the State of Washington have convinced us that the species is new, although properly placed in the genus Pulvinaria.

Bulletin 6 of the same station contains a short notice of the Woolly Root-louse of the Apple, with an interesting plate showing the roots of seedlings affected and unaffected.

Report of the Entomologist of the Louisiana Station.—Bulletin 22, second series, of the State Experiment Station at Baton Rouge, La., contains the reports of the officers for the year 1892. Prof. H. A. Morgan reviews his work of the season on pages 731–736. He reports that the Corn Root-worm (*Diabrotica 12-punctata*) destroyed many young corn plants, and that the greatest damage was done between the first of March and the first of May. Soaking the seeds of corn and melons in undiluted kerosene emulsion for twenty-four hours is stated to hasten germination and to ward off the attacks of the beetles. The adult insect is known in that part of Louisiana as the "Betsy Bug." Experiments with different solutions for use on cattle to keep off the Horn Fly showed that a fish-oil emulsion made by dissolving half a pound of common white soap in 1 gallon of boiling water, adding 2 gallons of fish oil while still hot and thoroughly churning the mixture for four

or five minutes, was more persistent in its protective effect than the other substances tried, which were Sludgite, Eucalyptus oil, Christ-Jeyes' fluid, and kerosene emulsion. The common Grass Worm (*Laphygma frugiperda*) was reported to have done considerable damage to the corn during the season.

The Department of Agriculture of British Columbia.—The second report of this Department, covering its operations for the year 1892, has just reached us. It is a bulky quarto volume and contains considerable interesting matter on the subject of insects. Aphididæ are reported to have been extremely abundant throughout the whole province, causing great loss to the hop and fruit crops. An inspector of fruit pests, in the person of Mr. E. Hutcherson, has been appointed, and he has been at work investigating the condition of the orchards in the different districts. Aside from plant-lice, Mr. Hutcherson reports that the Codling Moth is beginning to make its appearance, and states that the Plum Curculio has attacked the plums at Victoria. This announcement is one of great importance, if the observation should prove to be correct, as this insect has not been found west of the Rocky Mountains heretofore. The Flat-headed Apple-tree Borer and the Tent Caterpillars of the orchard and forest are also reported to have done considerable damage.

Economic Entomology in India.—The "Indian Museum Notes" issued by the Trustees of the Indian Museum at Calcutta, and which are devoted almost entirely to the subject of economic entomology, have been frequently noticed in INSECT LIFE. We have recently received No. 6, vol. II, and Nos. 1 and 2, vol. III, which contain the usual amount of interesting and well illustrated entomological articles. An important summary of the injurious insects of India is published in No. 6, vol. II. The insects are arranged according to scientific classification and the list contains 240 species. No. 1, vol. III, is a large number and contains a great variety of interesting notes, most of which are under the head of "Miscellaneous Notes." Lack of space precludes any extensive notice, and, in fact, most of the species treated are not found in this country. The Cheroot Weevil, an insect congeneric and of similar habits with our Cigarette Beetle, does much damage to India cheroots. The remedies consist in subjecting the cheroots to a temperature of 80° or 90° C., but since this injures the flavor of the tobacco, the means which we have urged in this country of destroying all refuse tobacco and keeping the leaves to be used in tight receptacles over night, are urged by Mr. Cotes. A great deal is said about injurious locusts, particularly about *Acridium peregrinum*, and an interesting account is given of an egg-parasite of the latter insect which Mr. Bigot has named *Anthomyia peshawarensis*. No. 2 of the same volume is

largely devoted to a consideration of the locust invasion of 1889–'92, and the history is interesting largely on account of the enormous numbers of locusts which were destroyed by hand for the Government bonus. In some of the villages it was not unusual for 10,000 people to be at this work at once. Eggs were destroyed to the amount of 50,000 pounds in some districts, while the locusts themselves were killed in such enormous numbers that in a single district, that of Jhang, 1,500,000 pounds were destroyed.

Technical Entomology at the Ohio Station.—Vol. I, No. 3, of the technical series of the bulletins of the Ohio Agricultural Experiment Station, published April, 1893, is devoted to entomological and botanical papers. Mr. F. M. Webster, Entomologist to the station, contributes an article upon "Methods of Oviposition in the Tipulidæ;" one on "A Dipterous Gallmaker and its Associates" (the gallmaker being described by Mr. John Martin as *Lasioptera muhlenberghiæ*); and some general notes upon some species of Ohio Hymenoptera and Diptera heretofore undescribed. The Hymenopterous insects are described in a supplementary article by Mr. W. H. Ashmead. We have seen two editions of this bulletin, one published with a cover and with the plates separately printed upon good paper, while the other has the customary form.

Virginia Station, Bulletin 1, New Series.—Various common injurious insects, with remedial measures for the same, are discussed by Prof. William B. Alwood in No. 1, vol. II, new series, of the Virginia Agricultural Experiment Station (Bulletin 24, January, 1892). The matter is elementary in character, dealing with well-known common insects, and includes also general directions for the preparation and application of the more important insecticides. Similar matter relating to fungus diseases and fungicides is also included.

Colorado Station, Bulletin 24.—Prof. C. P. Gillette, in Bulletin 24 of the Colorado Station, July, 1893, presents a similar publication, dealing, however, with garden pests, such as the Cabbage Worm, Flea-beetles, and Onion Thrips. An account, with a new figure, is given of the Two-striped Flea-beetle (*Systena tæniata* Say), which is generally injurious to garden vegetables other than Cucurbitaceæ in Prof. Gillette's experience, and some valuable notes on an Onion Thrips which has been very injurious the present season in Colorado, and which, from specimens sent us, was determined by Mr. Pergande as probably *Thrips striatus*, but which Prof. Gillette thinks, from certain characters which he figures, may be a distinct species. Should this prove to be the case, he proposes

for it the name *Limothrips allii*. Remedies for all the insects are given, that for the Onion Thrips being kerosene emulsion in the usual proportions thrown forcibly upon the plants, care being taken to thoroughly wet the axils of the leaves where the young congregate. He advises making the application in the evening or the early morning, when the mature forms are more sluggish than in the heat of the day.

Alabama Station, Bulletin 45.—Bulletin 45 of the Alabama Station (June, 1893), by Prof. J. M. Stedman, is still another republication of well-known facts about common insects and remedies, and will serve a very useful purpose in furnishing the farmers of Alabama with data for the recognition and treatment of insects which, from lack of circulation of older publications, have not been accessible to them hitherto.

Imported Beneficial Insects.—We have had little to say in INSECT LIFE as to the results of Mr. Koebele's last mission to Australia and the status of the imported insects, though we have endeavored to record every fact of importance connected with these insects. As the mission was undertaken under the joint auspices of the State Board of Horticulture and this Department, we recently instructed Messrs. Coquillett and Koebele to make a thorough examination of the colonies of imported insects, and report. It will be noticed from their reports, published in this number, that the insects from which the best results were expected, as indicated in previous numbers of INSECT LIFE (viz, *Orcus chalybeus* and *O. australasiæ*), seem to have increased at but one of the points at which they were colonized, and even here very slowly, while another species, of which little has been said hitherto, namely, *Rhizobius ventralis*, was found by Mr. Koebele to have multiplied in a remarkable manner at Santa Barbara.

We also publish a somewhat extended review of Dr. H. Rouzaud's important paper upon the life history of *Erastria scitula*, a European Lepidopterous enemy of the Black Scale, *Lecanium oleæ*. This insect we hope to import into this country in the near future, as, from all that can be gathered, it keeps the Black Scale effectually in check in parts of Southern Europe which, in climate, agree fairly well with that of Southern California.

AN IMPORTANT PREDATORY INSECT.

(*Erastria scitula* Rambur.)

An interesting paper upon the habits and metamorphoses of a predaceous Lepidopter destructive to Bark-lice has just been published by Dr. H. Rouzaud, of Montpellier, France. This insect, which is a small Noctuid moth, was carefully studied by Dr. Rouzaud during 1891 and 1892, and it has been ascertained that it is a very important factor in the life history of the Black Scale of the Olive, *Lecanium oleæ* Bernard, and of several allied Coccidæ. Although described sixty years ago by Rambur, the species has been little studied. The larva was unknown until Millière in 1875 published a statement that he had received specimens from Himmighoffen, of Barcelona, each of which

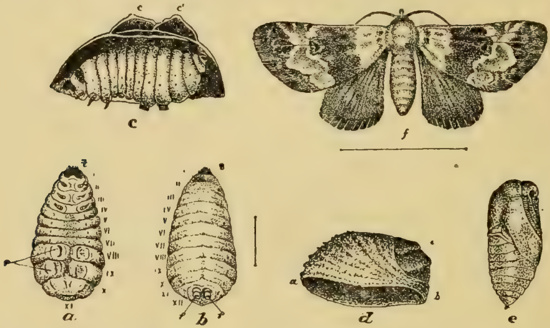


FIG. 1.—*Erastria scitula*; *a*, larva from below; *b*, same from above; *c*, above, in case; *d*, case of full-grown larva; *e*, pupa; *f*, moth—enlarged (after Rouzaud).

carried a sort of convex carapace or papyraceous envelope which served as a dwelling place, and in which it transformed. In 1884 the same author, upon the authority of Peragallo the elder, showed that the larva is predatory, feeding upon Coccidæ upon the Peach and plants of the genus Nerium, on the shores of the Mediterranean. The extraordinary form of the larva is mentioned, and it is compared, properly enough, with that of *Thalpochares communimacula*. The description, however, was not exact, as Rouzaud points out.

Rouzaud had been engaged in studying *Lecanium oleæ* for some years, and in June, 1891, observed an adult of Erastria ovipositing upon the

Coccids, and obtained some forty or more larvæ which he transported to the laboratory and watched in confinement. Struck by the enormous destruction of Coccidæ by these larvæ, he followed their transformations carefully throughout the season of 1892 and discovered five successive annual generations. The first appearance of the adults, few in number, occurred about the middle of May; the second, moderately numerous, towards the third week in June; the third, very abundant, about the middle of July; the fourth, equally abundant, about the end of August; and the fifth, again few in numbers, towards the end of September and during the early part of October. The falling off in numbers of the last generation is largely accounted for by the lack of food. The larvæ feed only upon large Bark-lice, those females which are full-grown or nearly full-grown, and such individuals occur most numerously in June, July, and August. Except during these three months, the only individuals at all abundant are of inferior size and retarded through poor nourishment. The falling-off in the number of moths in October results, then, from the fact that the September larvæ have not been able to find enough large Coccidæ.

The adult insects of both sexes resemble each other closely, and both afford a striking example of protective resemblance, simulating in repose sparrow droppings. The moths issue at the close of the day, and upon emerging from the cocoon are extremely active. Whatever the position of the cocoon, whether upon the leaves, branches, trunk, or base of the tree, the moths drop immediately to the ground after emergence from the cocoon. They jump, roll over on the back, and vibrate the wing pads actively for forty seconds and finally become perfectly motionless. Three or four minutes after birth their wings become expanded, and they fly up among the leaves and branches of the tree from which they have previously fallen. During daylight the moths remain motionless, the wings held close to the body, in which attitude, on account of their size, coloration, and general aspect, they bear the close resemblance just mentioned to the excrement of small birds. Copulation, which is of short duration, always takes place at night, the period during which the moths are active. The males live only one or two nights, in all probability, while the females in captivity live ten or twelve days at the least. Egg laying lasts several days, and each female produces about a hundred. These are deposited one at a time and each is separated from the other by a large interval of space. The female scatters them by preference upon the leaves or the young buds, although they are often laid directly upon the back of the Bark-louse.

The young larva at once enters its host, devouring all the internal organs, leaving only the dorsal carapace, which is more or less thick and hard. A Coccid which has been attacked always shows at some point or other on the dorsal surface an opening by which the predatory larva has entered. The young larvæ are of a red-wine color, except the head, which is brown, and this coloration lasts until

just before the transformation to chrysalis. At the time of the transformation, however, a bluish-white color is assumed. Although the size of the younger larvæ is not greater than that of the Bark-lice which they attack, they spin no silk at first and the spinnerets are rudimentary. As soon as the contents of one Bark-louse have been devoured the caterpillar abandons it and seeks a new prey, and is sometimes found exposed upon the twigs. Apparently realizing the necessity for protection, as well as additional food, it hastens to bury itself in a new victim, which usually is a matter of but some minutes. After having entered a Bark-louse it seems to be effectually protected from parasites. After ten days, and after having passed through several molts, the exact number of which has not been observed, the larva begins to construct a silken covering spun from the spinnerets, which make their appearance only at this late stage. This covering enlarges the case formed by the coccid shell and to it are attached excrement and the débris of the Coccidæ. This artificial case the larva now carries about with it, during its final stage. It has left an opening for the head and feet, and in fact for the larger part of its ventral surface and crawls about, devouring several Coccidæ every day. The covering is held in place by the anal prolegs, two pairs of abdominal prolegs being functional. As the larva continues its destructive work it is with difficulty perceived. Hidden in this case, which it never leaves, and from the anterior of which only the head, which is coriaceous, small, and blackish, issues, it is very difficult to distinguish it upon a surface covered with smut fungus, as twigs infested by black scale usually are. The efficacy of this protection is indicated by the fact that, although several hundreds of cocoons of Erastria were obtained by M. Rouzaud, upon only one occasion did parasites emerge instead of the moth. In this instance 50 small Chalcidids were reared, and so far as he is able to judge, the species is identical with one which he reared from a Coccinellid (*Exochomus quadripustulatus*). In this statement, however, we are inclined to think that M. Rouzaud is mistaken.

Upon arriving at full growth the larval case has become enlarged far beyond the dimensions of the original Bark-louse, which in fact now occupies a superior position on the anterior end of the case. The case has been built out with silk, excrement, and the fragments of eaten bark-lice to a distance of perhaps four times the length of the full grown Lecanium and nearly three times its height. The larva then searches for a favorable position in which to fasten its case, prepare its cocoon, and transform to pupa. It chooses a leaf very rarely and is more often found in the angle formed by two branches, or in large crevices in the bark of the trunk. Perhaps most frequently it is at the collar of the trunk, where the bark is roughest, that the cocoon is found. The cocoon is formed by increasing the silk layer and completing it beneath the larva, first clearing the surface upon which it is to be fastened by means of the mandibles. Five or six cocoons are sometimes found together on the

upper part of the trunk, but at the collar they occur by hundreds, so that they are frequently fastened one upon another. Two-thirds of the completed cocoon is formed by the larval case, the remainder being composed of new silk spun for the purpose. Before transforming, however, the larva prepares a point of exit for the future moth by gnawing nearly through the wall of the cocoon at the point nearest the old place of exit of its head from the larval case.

In concluding his summary of the life history of the species, M. Rouzaud devotes some attention to the possibility of transporting the insect from one place to another. The half-grown larvæ are able to support a journey of eight days without nourishment. They will not destroy each other, as is the case with other carnivorous larvæ, but content themselves with gnawing the stopper which incompletely closes the tube and permits the access of the air. Upon their arrival they need only be placed upon plants infested with Coccidæ. During the entire summer it will be easier to send the larvæ in this way. Cocoons containing full-grown larvæ or chrysalides can also be transported in the same way, and will stand a journey of eight or ten days in midsummer. In this case, however, it is best to wrap a few well-stocked twigs with gauze and inclose the cocoons in the center. If the moths emerge, they will couple and deposit their eggs on the journey. It is then only necessary to attach the twigs to those of infested trees. In the winter time it is easy to send the cocoons or eggs a long distance, and there is no reason why Erastria can not be acclimatized in Australia, California, and Cape Colony.

In discussing the conditions under which Erastria may be efficaciously employed against *Lecanium oleæ*, there is one point of prime importance to be observed, says M. Rouzaud:

> It will be necessary to have at hand a sufficient number of young larvæ (that is to say, of larvæ which have a tolerably long life before them), and many Bark-lice for them to devour; to satisfy the first condition I see no way but to breed the larvæ on a large scale. With this end in view, it would be possible to raise early larvæ in a greenhouse on bushes more advanced than those out of doors, and subsequently to carry these larvæ to an infested plant. It might even be possible to discover an animal nourishment which would suffice for a sort of artificial feeding of the young larvæ. I believe that oleanders suitably forced towards the end of the winter and well stocked the preceding summer with young *Lecanium oleæ* could be readily used in the production of early larvæ of Erastria on a large scale. But I also believe that a true artificial food may be found for them, easier to produce and distribute than living prey. In either case, of course, everything is yet to be done and the field is open for research; the end to be attained seems to me worthy of the most skillful experimenters. Admitting that a sufficient quantity of the larvæ are at hand, and that the problem of rearing them on a large scale has been solved, a second very important point to be observed is, that they shall be put to work at the right moment, say just before the eggs are laid by the Bark-lice, or at least before the issuance and spread of the young.

In sending us copies of the important paper which we have thus reviewed, M. Rouzaud has kindly offered to transport to this country

for experimental purposes, living specimens of this extremely valuable insect, and we have arranged to accept his kind offer to attempt the introduction of the species into California upon a somewhat extensive scale. Up to the present time *Lecanium oleæ* has not been found elsewhere in this country, except rarely in greenhouses, but it is extremely abundant in California, not only upon the Olive but also upon Citrus trees. It can hardly be considered one of the most destructive of the California scale-insects, but it is a very injurious insect and damages trees not only by its own excessive multiplication, but by the extraordinary quantity of smut which follows its appearance, due undoubtedly to its copious secretion of honey dew. Although the Black Scale possesses in California as well as in Hawaii an efficacious parasite in *Dilophogaster californica*, the latter does not breed rapidly and seems to have but two annual generations. Occasionally this Chalcidid reaches a point where it destroys from 75 to 90 per cent of the Black Scale upon a given tree, but such an occurrence is always followed by a rapid restocking with the scales, and the benefit is by no means permanent. In Erastria we have a much more rapid breeder, and if it should accommodate itself to the somewhat changed climate, as we anticipate, its introduction will prove a boon to the California fruit-grower. In discussing different methods of importing the insect, M. Rouzaud has overlooked, as it seems to us, the fact that it will be dangerous to bring it over in any condition except the egg. Although parasites seem scarce, the known existence of one indicates the possibility that at any time an infested larva or chrysalis may be brought over and in some degree vitiate the success of the experiment. Even at this early date M. Rouzaud deserves the gratitude of our fruit-growers for his public-spirited proposition.

Other things being equal, the Erastria will prove a most profitable insect to introduce into California for work against the Black Scale. It comes from the native home of the scale insect and is there an effective enemy of the species. The Dilophogaster above mentioned is not European, and has this disadvantage in addition to that of slow breeding. On another page of this number of INSECT LIFE is mentioned, on the authority of Mr. Koebele, the effective work of *Rhizobius ventralis*, on the Citrus trees infested with Black Scale in a grove belonging to Mr. Elwood Cooper, at Santa Barbara. This is one of the lady-birds sent over by Mr. Koebele during the late expedition to Australia and it has been extensively disseminated. If it continues to work as effectively as reported from Santa Barbara, the necessity for the introduction of the Erastria may cease, though no harm can result from the latter's introduction, and there are some reasons for concluding that it will prove the more effective of the two.

NOTES ON TASMANIAN COCCINELLIDÆ.

By E. H. THOMPSON, *Tasmania.*

Your many kindnesses in sending the very valuable publications of your Department make me venture to address a few lines to you on the subject of our Coccinellidæ, the more so as some attention was drawn to them by Prof. Webster in INSECT LIFE, vol. II, p. 287. Although I do not for a moment pretend that all our Tasmanian species have been discovered (more than half of the island is still a *terra ignota*, and covered with impenetrable scrub), still I think that as far as the inhabited portions of the Colony are concerned there are not likely to be many more Coccinellids at work, as I have traveled through the length and breadth of it during the last eighteen months and have specially kept my eyes open for Lady-birds and other friendly insects. I place *Leis* (or, according to Masters's Catalogue of Australian Coleoptera, *Coccinella*) *conformis* Boisd., as first in the list. Not only is this beetle the most numerous, but certainly the most useful. I have found it preying on the *Icerya purchasi* (which it completely kept down or cleared out entirely), on the Mussel Scale (*Mytilaspis pomorum*), *Schizoneura lanigera*, *Aphis brassicæ*, *Aphis rosæ*, *Rhopalosiphum* sp., and also on the different scales attacking our Peppermint and ordinary Eucalyptus. The larvæ are large in proportion to the size of the imagines, and are black with two yellowish orange bands at second and third molt, finally attaining two more colored bands. When first hatched they are quite black.

I have reasons for believing that the larvæ of Leis and of the small black Scymnus are both subject to parasitic attacks, but so far I have not been able to secure the culprit. The next Lady-bird as regards usefulness and activity is *Cleodora mellyi* Mulsant, so named for me by Mr. George Masters, of the Macleay Museum, Sydney, New South Wales. This is a comparatively unknown Coccinellid in Australia, as it was not recognized by several experts to whom I showed it. I just discovered it last year at Devonport, on the northwest coast of Tasmania; since that I have found it in the South. I can always secure many more larvæ and eggs than I can of the perfect beetle. It is very active and flies at the least disturbance. It so far seems to be confined to small Eucalypts, which are covered with *Eriococcus eucalypti* Cr., and other similar scales. The larvæ are much broader than those of Leis, and instead of having continuous bands of yellow, have a series of pale yellow dots on eight segments arranged somewhat regularly. The imago is a very large Lady-bird, and the elytra are very much pointed. Commencing from the two "comma"-shaped markings, there is a distinct carination which extends along the anterior margin to the next series of markings. From its size and rapacity this Lady-bird must do a vast amount of good, but I have never yet found it working on economic plants or trees. The fourth insect is much smaller than *Leis*

conformis, and is, I believe, undoubtedly *Coccinella repanda* Thunberg, though I do not find it catalogued under that name by Mr. Masters. This Lady-bird is generally associated with Leis in its attacks on *Mytilaspis pomorum*, and in one or two places in the south of the island, they have, unaided, completely stamped out the scale. They make a small round hole in the top of the scale and devour the eggs. This last year (1892) I found the gardens about Brighton, in the midlands, perfectly alive with the larvæ of these two Lady-birds, but I could discover but little for them to feed upon except the Rose Aphis. Perhaps I visited the district too late, and their work was done. The third Lady-bird I have only found in one part of the island, Scottsdale. It is described by the Rev. Mr. Blackburn, of South Australia, as *Verania frenata* Erich. (*Alesia frenata* Erich., according to Masters's Catalogue) I found this Lady-bird only in its perfect form: I hunted well about for larvæ, but I could not discover them. It was feeding ravenously on the Woolly Blight (*Schizoneura lanigera*). The fifth Coccinellid puzzles me. On examining the specimens in the Sydney Museums I find that there is a very marked difference in the appearance of the Australian and Tasmanian specimens. Here they are, with the exception of the six orange spots, of a uniform lustrous blue-black metallic color, while the Australian specimens show gradations of shade and color as shown in Fig. 1, Pl. IX, p. 67, vol. II, part 2, of the New South Wales Agricultural Gazette, 1891. I do not pretend to say without further information, but I am inclined to think they must be different. Two black Scymni are extremely common in places under the loose bark of Eucalypts. I seldom found them on economic plants. Owing to the elongated compressed shape of the first of these I was at first almost inclined to think that I must be mistaken and that it was a phytophagous insect, a Paropes, for instance, but on examination I find that it is undoubtedly a Coccinellid. It is only sparsely pubescent, while the other one is largely so. The last four or five segments of the abdomen are of a distinctly yellowish brown or fulvous color. It is hemispherical and at times very small indeed, though possibly there may be different species. I shall be glad to send you specimens of any or all of these insects if they would prove interesting to you.

EXPERIMENTS WITH THE HOP LOUSE IN OREGON AND WASHINGTON.

(Report of an investigation made under instructions from the Entomologist.)

By ALBERT KOEBELE.

I arrived at Portland, Oregon, April 19 and visited Prof. F. L. Washburn at the Experiment Station at Corvallis, Oregon, who has had this insect under observation for some time and who has published valuable

information in Bulletins 10 and 25, of his station, both as to the life history and known remedies. Mr. Washburn kindly advised me as to the best locality in which to carry on the experiments and also furnished me with a list of hop-growers. Aurora was selected as a central point for operations. The season was very backward when I arrived there on the 26th, the plum trees only just coming into blossom, and for the preceding five weeks there had been more or less rain daily.

The most important point was to ascertain if other plants or trees than Plum and Prune existed upon which the winter eggs are deposited, and all plants were consequently examined during the whole time of my work up to June 25. In no instance could the lice be found on any other than the plants mentioned. A Phorodon feeding upon mint is without doubt a distinct species, as it could not be induced to feed upon the hop vines, and its migrant has been observed to leave its offspring upon the mint.

With the exception of seedling plums, upon which the stem mother was found, no other wild plums were met with, and upon all the wild cherries examined, both in Oregon and Washington, no trace of the Hop Louse could be found. It was not until May 12 that the first colonies of *Phorodon humuli* were met with upon various plum and prune trees, the stem mothers with their offspring chiefly, yet in some instances young of the third generation. As late as May 23 stem mothers with but few young were found, and on May 26 the first winged migrant was observed. With the beginning of June the winged insects could be found almost anywhere, yet not in large numbers, and a week later the young of this generation could be found occasionally upon the hop vines. This has been an unusually late season, and in ordinary years the lice may be expected to appear upon the vines about three weeks earlier.

The Hop Louse has been, generally speaking, not numerous, while the predaceous insects have been very abundant, so much so that in the early spring in some of the yards before they were plowed, from fifty to seventy-five lady-birds could be counted to every hill. These were attacking two species of Aphidids, which occurred on weeds, and to some extent on the hop vines, which they speedily cleared of lice and had to leave in search of food elsewhere. The more numerous of these lady-birds, numbered 8, 4, 5, 3, 2, 7, 11, and 14, following the order of their abundance, I have forwarded for determination.* No. 14 was always present whenever hop lice occurred. Many of the colonies of Phorodon under observation upon plum trees were entirely destroyed by these lady-birds, and chiefly by No. 8, which is a most active little insect. Other predaceous insects, such as Syrphidæ and Chrysopa, were also present in large numbers, and on one occasion upon plums. A

---

* The Coccinellids sent by Mr. Koebele represent the following species: 8, *Adalia frigida*, var. *barda*; 4, *Hippodamia spuria*; 5, *H. parenthesis*; 3, *H. 13-maculata*; 2, *Coccinella transversoguttata* and its var., *transversalia*; 7, *Harmonia 14-guttata*, var. *cardisce*; 11, *H. 12-maculata*; 14, *Scymnus nebulosus*.—Eds.

Braconid was observed to oviposit in the second generation of *Phorodon humuli.* The parasitic insect could not be obtained, nor could any parasitised lice be found later, as all were eaten up by Coccinellidæ. It is quite natural that these valuable predaceous insects should increase to such an extent with the appearance of the Hop Louse in Oregon and Washington, and last year also the lice were kept in check to some extent, and only in certain yards was serious damage done. From all appearances it is hardly likely that the hop louse will do serious injury the present summer.

Whether the only true parasite of the ladybirds known here as *Euphorus sculptus* Cr. will ever become numerous enough to reduce the vast numbers of Coccinellidæ is, in my opinion, rather doubtful. I have bred this parasite from the following species found in Oregon and Washington: Nos. 4, *Hippodamia spuria;* 5, *H. parenthesis*; 6, *Coccinella julians;* 8, *Adalia frigida.* Owing to the backward season the other predaceous insect enemies of the Hop Louse could not be obtained. It may be said, however, that the species of Syrphids living thereon will prove to be many.

REMEDIES.

As requested, I have tried the more effective remedies recommended in your report of 1888 as far as was possible upon the few Phorodon found upon plums and prunes. No experiments could be made upon the hop vines, as up to the end of June but few lice appeared on them, and it was only where the Phorodon were taken from the plum trees and placed upon the hop vines that a few tests could be made. The results obtained were essentially the same as stated by Mr. Alwood.

Kerosene Emulsion.—This was prepared as in Mr. Alwood's experiments: Oil, 8 pints; water, 4 pints; soap, one-half pound. It was used on Phorodon, on plum and hop vines, diluted twenty-five times, and the results were not quite as satisfactory as could be wished, the wash settling in drops and leaving some marks upon the leaves, while many of the lice escaped being killed. The emulsion prepared with 1 pound of soap and sprayed upon prunes gave no better results. An emulsion prepared with 1 gallon of kerosene, 2 gallons of resin compound and diluted to 75 gallons of wash did not work satisfactorily, as it would not spread as well as fish-oil, soap, or resin compound, and also left marks upon the leaves of hop vines treated. This latter emulsion is very easy to prepare, and its cost is about 18 cents for the 75 gallons.

Soap No. 1.—This is Alwood's formula, yet instead of using Leon Hirsh's crystal potash lye, Babbitt's potash lye was used, as the first-named article could not be obtained. The soap is indeed an effective agent against Aphides, and, as far as the cost and efficiency are concerned, is one of our best remedies. Babbitt's potash lye, 1 pound; fish oil, 3 pints; soft water, 2 gallons. The lye is dissolved in the water and when brought to the boiling point the oil is added and the

batch should be boiled about two hours. When done, if filled to make up the evaporation by boiling, there will be about twenty-five pounds of soap, enough for 150 gallons of effective wash, and costing about 23 cents.

Soap No. 2.—Babbitt's potash lye, 2 pounds; fish oil, 6 pints. The lye is dissolved in four gallons of water, the oil added, and boiled for about two hours. After the soap is complete a decoction of 2 pounds of tobacco stems is worked in. This makes about 40 pounds of soap and, diluted with 400 gallons of water, will make an effective wash, the cost of which is about 50 cents.

Soap No. 3.—This is a resin soap made with 4 pounds of resin, 2 pounds of tallow, and 1 pound of Babbitt's potash lye. It made 20 pounds of good hard soap and was used at various strengths, yet did not work satisfactorily, compared with other washes, and it is not recommended.

Resin Compound.—It is to be regretted that this valuable insecticide for soft-bodied Coccidæ and all Aphididæ has been so neglected as a means against the Hop Phorodon. I have, on former occasions, recommended this insecticide as the best for destroying this insect, and have not as yet come to any other conclusion. It is certainly one of the simplest washes to prepare, and a failure in producing a properly saponified resin brings no bad consequence to plants, and at the most affects only the operator's temper by constantly clogging up the nozzle. Three pounds of common washing soda (carbonate of soda) will dissolve four pounds of resin. One pound of caustic soda, about 76 per cent strong, will dissolve 6 pounds of resin effectually, but not more. In dissolving the carbonate of soda, water only should be added. The broken up resin in a kettle, covered with this solution, should be boiled thoroughly until the resin is well dissolved, not leaving any soft lumps which will not dissolve later. Hot water should be added while boiling or cold water in small quantities to make about five gallons of compound. This, before cooling, should be diluted with cold water.

One pound of caustic soda is dissolved in 2 gallons of water and 6 pounds of broken resin are boiled with about 3 quarts of the lye. After being well dissolved the rest of the lye is added slowly with water to make about 8 gallons of compound, which should be diluted with water before cooling. In preparing the resin compound it is important to secure a resulting clear, brown mixture, at which stage it is ready to be diluted with water. A milky appearance indicates an imperfectly saponified resin. Resin is sold at Portland at $4 per barrel of 280 pounds. Six pounds of saponified resin, as given above, will cost about 17 cents and will make 75 gallons of a strong wash. If diluted to 100 gallons it will still be very effective—in fact, rather better—since the various insects preying upon the Aphidids are not destroyed by a wash of this strength.

The action of resin wash upon Aphididæ is immediate. After being

sprayed they raise their honey tubes and remain in this attitude in all dead specimens. The wash can be used at any time and upon any plants with safety at 1 pound saponified resin in 12 or 15 gallons of water, and even stronger.

I have used 1 part of compound to 20 parts of water with some tobacco decoction and it still spread well and destroyed the Phorodon. Resin compound, 1 pint; tobacco water (1 pound of tobacco stems boiled to 4 gallons decoction), one-half pint; water, 14 pints. This destroyed all the lice, yet I am not prepared to say what effect it will have upon the predaceous insects living upon them.

As a penetrating and adherent basis for any insecticide or fungicide, resin compound stands at the head.

Quassia and soap No. 1.—This is the same as given by Mr. Alwood, as follows: Quassia, 6 pounds; soap, 3 pounds; water, 100 gallons. This was sprayed on Phorodon upon prunes at various points and the result was not satisfactory. The numerous ants attending the Aphidids were not destroyed by this wash, and they carried off all the lice not destroyed by the application the following day, leaving the immature lice dead upon the leaves. The action of the quassia is very slow and considerable time elapses before the lice are all destroyed. Quassia, 1 pound; soap No. 1, one pound; water 22 gallons, gave results similar to the above. These washes do not spread so well as the fish oil and resin washes, and many lice escape in consequence. They furnish, however, a fairly good remedy, but the quassia chips are somewhat expensive, being sold here last year, I am informed, at 10 cents per pound, retail price. The present season the price is 6 cents per pound. While in Oregon I met with an English gentleman who is also selling quassia chips in England at a price less than 2 cents per pound, and he assured me that he is deriving a profit of 35 per cent, and I have been informed from various sources that dealing in quassia in this country is a very profitable business. As employed at present, 8 pounds of quassia and 6 pounds of whale-oil soap are used in 100 gallons of water, the ingredients costing something like 96 cents.

Sapocarbol.—This is a highly spoken of German remedy against various Coccidæ and Aphididæ, and is in use against the Hop Louse. Mr. Kola Neis, of Springfield, Oregon, received a sample from the manufacturers and I had opportunity to test it. The article is diluted to from one-half to 3 per cent strength with water. It was used upon Phorodon upon prune first at 2 per cent strength. This spread well and killed every louse, yet burned the leaves badly. At 1 per cent the wash was still soapy, spread well, and killed all the lice, yet left marks on the leaves where the lice were thickest. The substance is a good insecticide, but costs too much for popular use, being sold at the factory in Eisenbüttel at 80 marks per 100 kilograms.

In the spring, from two to three weeks after the appearance of the leaves on Plum and Prune upon terminal twigs, the stem mothers

with their offspring can be seen in clusters, and it is at this time very easy to destroy them by spraying, or even better, by hand-picking, which method I consider the best. I have myself gone over a Plum and Prune orchard twice, and was able to gather all the Phorodon present in a very short time. Mr. H. J. Miller, of Aurora, Oregon, at my request, kindly consented to collect all the lice upon his trees by going over his orchard three times at weekly intervals, and succeeded remarkably well in cleaning them entirely of Phorodon, and this simply by hand-picking. To kill the lice a kerosene-oil can was used filled about half with water and with 1 quart of kerosene, into which the branches with lice were immersed. I am confident that if, at this season, a united war were made against the Phorodon very few would ever reach the hop yards. A strong kerosene emulsion as a spray applied to Plum and Prune trees in the autumn and winter would destroy most of the eggs, and hand-picking or spraying in spring would almost, if not wholly, prevent these insects from migrating to the hop yards.

REPORT ON OUTBREAKS OF THE WESTERN CRICKET AND OF CERTAIN LOCUSTS IN IDAHO.

(Report of an investigation made under instructions from the Entomologist.)

By ROBERT MILLIKEN.

Owing to the shortness of the period in which I was enabled to give attention to the work, and other matters requiring a part of my attention, I have been able to attend only to the distribution and general characters of the insects under consideration, and could not investigate in detail as I would have been pleased to have done.

I have been able to learn of but two areas in the State in which locusts have caused any serious loss of crops, one being the valley of Boise River in Ada and Canyon counties, extending from a few miles below Boise city to the confluence of the Boise with Snake River, and the other the Big Lost River Valley in the eastern part of Custer and Alturas counties in eastern Idaho.

I made two visits to the Boise Valley, the first one the 24th of July, 1893, and found locusts doing much damage in places, but not uniformly distributed over the valley, being, in places, abundant enough to ruin oat fields and the second crops of clover and alfalfa, and being particularly destructive to young orchards and gardens along the edges of the valley. Much interest is being manifested in this part of the State lately in fruit culture, and many orchards of Prunes, Peaches, and other fruits are being set out, and the locusts have, in many cases,

caused much damage by eating the foliage as fast as it grows on the young trees. I found cases when it became necessary to cut fields of oats green and convert the crop into hay, the hoppers having taken the blades and heads from a good part of the crop on the borders of the fields. They did not appear in sufficient numbers early enough to materially injure the first cutting of alfalfa and clover, of which large quantities are produced, more than to denude the stalks of a part of the foliage, but I saw fields cut early in which the hoppers kept ahead of the second crop notwithstanding free and careful irrigation, so that the fields were as brown and bare on the 7th of August as they had been the 1st of July, when the first crop was removed and stacked

From the best information obtainable I could not learn that these locusts were from swarms invading this region from any outside territory, but were of the nonmigratory species which breed from year to year in the valley.

The Boise River takes its origin in the mountains of central Idaho, entering the Snake River Plains about 10 or 12 miles above Boise City through a canyon, and takes a course nearly westward along the low foothills flanking the higher mountains of the central plateau of the State for a distance of 25 to 30 miles, when it makes a detour towards the west across the plains, entering Snake River about 50 miles from its effluence from the mountains.

These foothills rising gradually from the edge of the great arid Snake River Plains to an elevation of from 200 to 2,000 feet have from time immemorial been the favorite hatching ground of a number of species of locusts which frequently become so numerous that they overrun the adjacent valleys and cause great destruction to the crops of the "rancher" who may be so unfortunate as to be in their path. Settlers have been in this valley now for about thirty years, and it appears that periodically the locusts invade their farms for a time and then disappear for seven or eight years and then increase again.

Some of the more imaginative ones have conceived the theory that the locusts are, like the cicadas, periodic, and that the eggs lie in the ground for a certain period of about eight or nine years, when they hatch in great number, again, after a certain time, to deposit eggs and disappear as before. It has taken considerable argument to convince them that this is not the true theory of the periodic invasion.

It seems that both locusts and crickets have the same periodic character, following each other closely in their time of appearance, flourishing for a few seasons and then nearly disappearing, the periods of frequency being about ten years, 1872, 1883, and the present year being notably years of abundance.

I have been unable to learn of any well authenticated flights of locusts into this valley from other sections, although there are traditions and rumors of such, but whence, I could get no definite information, though more intelligent persons with whom I talked told me that they hatch in

the foothills adjacent to the valley, and are to be found in these places at all times, and periodically overrun the valley.

What the extent of this invasion will be is, of course, problematical. This is the third season in which they have been increasing perceptibly and doing damage in the valley, getting more and more numerous and doing greater injury each year, and extending over more of the cultivated part of the valley as they increase. If the increase next year should be in proportion to that of the last two years, great loss of crops will occur along the valley of the Boise River and for some distance out on the plains, where much territory has recently been brought under cultivation by the construction of irrigation ditches.

There are several species of locusts to be found in the infested fields, but the greater number are referred to *Camnula pellucida* (*C. atrox?*) *Caloptenus bivittatus*, and *C. atlanis*, with a smaller number of *C. devastator* and *C. cinereus*, and quite a sprinkling of *Dissosteira longipennis* and *D. carolina.*

One thing that seemed remarkable to me was the great diversity in ages and sizes of the insects, which did not seem to be confined to any particular species exclusively, ranging from larvæ scarcely a day old to full-fledged insects, in many cases pairing preparatory to egg laying for a new brood.

I was unable to learn in the limited time at my disposal that parasites or diseases were prevalent to any considerable degree, further than that the red mite was to be found on quite a number of specimens, and that a few were dying from some apparent fungus attack, but I could not determine its nature.

The affected insect would attach itself firmly to a stalk of grain or grass, so firmly that it could not readily be removed entire, and turn to a dark leaden hue, the whole interior cavity of the body being filled with a semi-liquid mass, the tissues of the body being so destroyed that the insect would fall apart almost with its own weight, even before life was wholly extinct. This condition was observed at the time of my first visit, July 24, and seemed to affect quite a number of the insects, in which I could find nothing having the appearance of parasites.

At my second visit, August 7, no such diseased insects were to be found, but thousands of empty shells of their bodies were lying about, a dozen being common in the area of a single yard, but whether the contents of the bodies had been removed by some kind of parasite or death was the result of fungoid disease, I was unable to satisfactorily determine. It was evident the cause that was operating in the first instance had passed its season. I, however, found one case in which the body contained two larvæ of some kind of Tachina fly, but have no assurance that this caused the general destruction so prevalent throughout the field.

Egg laying had apparently not yet begun, but a number were seen in coition; in one case a pair were destroyed by the disease in that position, the empty bodies being together.

The other section in which the locusts are doing damage, as before described, lies in the eastern part of the State, in the mountains, and not contiguous to the plains as in the Boise Valley.

This region being far from the railroad, about 75 miles from the nearest point, I was unable to visit it, but was fortunate to meet a very intelligent gentleman, Mr. Alex. Burnett, of Antelope, in the Lost River Valley, who gave me very valuable information regarding the locust visitation in that region.

In the summer of 1891 the locusts came into the Big Lost River Valley by flight, coming chiefly from the southwest, presumably from the Camas prairie country to the west of Wood River. They laid eggs quite abundantly, both in 1891 and in 1892, so that they are completely denuding the farms in many parts of the valley from Arco to Huston. They have not yet acquired their full growth, but if they deposit eggs as generally as in the two past years, they will eat everything up in the entire valley. The kind is not determined, but Mr. Burnett will send specimens of the insects so that the species may be determined. They are presumed to be *Camnula pellucida* from description.

In neither locality has any effort been made to combat the destructive tendencies of the locusts, all trusting to natural causes to reduce the numbers as in the past. It will be interesting to note the condition in another season, when more time with better facilities for study and observation will be at my disposal for the purpose.

The people of Idaho give little attention to the locusts, as they are to a great extent local and much restricted in their ravages, but the Great Plains cricket, *Anabrus simplex*, is causing a good deal of consternation over quite an area of the middle portion of the Great Snake River Plains and the mountain region to the north, chiefly along Wood River and its tributary valleys.

Wood River is the only stream from Henrys Fork which takes its rise in Yellowstone National Park to find its way across the great lava plain of the Snake to that river, the others losing themselves in the lava beds to emerge as immense springs in the great canyon of the Snake. Wood River takes its rise in the great central plateau of Idaho and has a course nearly south of about 100 miles, and with its tributaries furnishes some of the finest agricultural lands in the country, as well as an immense area of the best mountain grazing lands in the northwest. Any disaster to the crops of this region will of course be a great misfortune.

The northern boundary of the plains of Snake River consists of an irregular crescent-shaped series of hills or low mountains, the outposts of the higher mountains lying to the north, and becoming so celebrated for their rich mines of gold and other metals.

In these foothills, along Wood River and for a distance of 50 to 60 miles to the westward, is where the crickets have this year become so numerous as to do a great deal of damage. They have been known to exist

for thirty years and more, and to hatch in limited quantities annually along the south side of these hills and on the edge of the adjacent plains, but never until this year have they become so numerous as to cause serious damage. This may be accounted for in two ways. First, they are like the locust, periodic in their increase and decrease, owing, presumably, to the effects of parasitic and other enemies, and, secondly, because since their last appearance in destructive numbers most of the land now in cultivation has been opened up to irrigation and farming.

The locusts, as found in 1891 by Prof. Lawrence Bruner, have almost wholly disappeared from this region. During a visit, July 30 to August 4, in Wood River Valley, I was able to find none to cause any alarm, only a few colonies of *Camnula pellucida*, and one noted for the bright blue of its legs, but which had not attained wings, and I was unable to determine its species, with scattered specimens of the usual residents, such as *C. bivittatus*, *C. atlanis*, and *Dissosteira obliterata* (?).

The locusts have vacated and the cricket has taken possession. They have been increasing noticeably for the past three years, each year working farther out upon the valley, and ovipositing wherever the season overtakes them, from the banks of Snake River to the tops of the mountains, 75 miles to the north.

I collected insects on May 14, at Taponis, on the Wood River, 16 miles west of Shoshone, scarce a day old, and learn that they have been abundant between Taponis and the river, having hatched at various points in the valley.

I learn that they hatched in considerable numbers on the top of the mountain lying east of the town of Hailey, close to the edge of the snow line, where the elevation is not less than 7,000 feet, as well as on other mountains to the west of Hailey and Bellevue.

I can not learn that they prevail to the east of the valley of the Little Wood River, which is one of the branches of Wood River, or that they extend to the west more than about 100 miles. The south branch of Boise River takes its rise in the mountains adjacent to the Wood River and has its upper course infested with the crickets. Great quantities were carried down the Boise River and, finding their way into the irrigating canals, were carried out onto the land in the country adjacent to Boise City, when they escaped by the millions and scattered over the land. So far as I can ascertain, they have all been destroyed which thus invaded the lower country before attaining their maturity.

The farthest to the west in this region in which they have bred this year is in the foothills at the head of Indian Creek, 5 miles to the northeast of Bisuka Station, or as it is now proposed to call it, Orchard Farms, on the Union Pacific Railroad, in township 3 east, and range 1 north, extending over to the headwaters of the Boise River.

I found no crickets more than 3 miles north or east of Hailey. The territory covered by them may be described as being covered by all of Ellmore County, the west half of Custer and Logan counties.

A small area is reported from the central part of Washington County, near Salubria, but to what extent they have been destructive I have not been able to learn.

A region known as Camas Prairie, lying to the west of Wood River in Alturas and Logan counties, seems to have suffered most. The permanent breeding grounds seem to lie 20 to 40 miles south of the Camas Prairie, and when they have become too numerous to support themselves in their usual haunts they strike out for pastures new, and it seems that this prairie got more than its share of the excess. D. C. Daugherty, of Soldier, writes me that—

> Three years ago we had a very few in our locality on the prairie, a few more the following year, and this year millions, covering almost every portion of our beautiful valley—the larger portion of the same coming from pests that have been so numerous in the mountain range 20 to 40 miles south of the valley.

On a visit to Wood River, I had numerous reports verifying Mr. Daugherty's statement, and saw, from the foot of the mountains to Hailey, swarms of them, containing untold millions, devouring every green thing in their track. If there was nothing else for them to devour they would eat each other. It is not an uncommon sight to be able to count 20 clusters of insects where a half dozen or more had pounced on one of their number, and were proceeding to make a meal of him. It is a well-observed fact that whenever one gets disabled or injured in any way, his associates proceed to make a meal of him in short order.

Those which hatched on the south side of the mountains, especially if a little distance on the plains, when they were ready to migrate, took a south or southwest course, and by the first of August had nearly all crossed the Union Pacific Railroad and were well on the way toward Snake River. I was told by a farmer at Bisuka that they had then, July 21, been depositing eggs about his place, but the insects had passed on and wholly disappeared from the vicinity. Eggs were being deposited freely at Hailey August 2, and at Picawbo, 20 miles south, August 5, as observed by me personally.

I could see no signs of disease amongst them, nor parasites other than Red Mites; very abundant at Hailey, but few perceptible on those at Picawbo. A newspaper correspondent, writing to the Boise Statesman from Glenn's Ferry, reported the insects dying from some unknown disease. Also, Mr. Daugherty, above quoted, says:

> At Fir Grove, 12 miles south of this point, and located at the south line of foothills, parties recently report that the crickets are dying off by millions from disease; and same report comes from points farther south.

I had not the opportunity nor time to investigate the truth of these reports. It occurred to me that possibly it might be that these were early swarms which had oviposited and were dying from natural causes; as to the south, where there was but little snow, they hatched a month or more before those in the mountains.

Many interesting and marvelous stories have been told of the crickets, how they fill up irrigating ditches, get into the flumes of mills, stopping the wheels with the mass of their bodies, and filling rivers, forming bridges so that the advancing army cross over safely on the dead bodies of their comrades, etc. I can readily believe them, for when their great size is taken into account, together with the countless millions in which they occur, and the well-known propensity to go straight ahead, turning neither to the right nor left, one can readily understand that an obstruction will soon take place if the advancing army keeps on its course. It is a standing joke that the crickets will not turn aside for a telegraph pole if it is in their path, but will go up one side and down the other to keep in the line of their journey. It is a well-known fact that a stream of water is no obstacle to their advancement, as they leap in when they come to it as if the stream were not there. In this way many perish. What another season has in store for the people of the infested sections of Idaho is a question fraught with great concern, and can be determined only by waiting patiently the outcome.

Eggs are being deposited over the entire area overrun by the hungry horde, from Snake River to the mountains, and if the increase in numbers in 1894 is in the same ratio as that of the two past seasons, there will not be a green thing left in the valley. As they travel at the rate of a mile a day they may overrun a considerable part of the adjacent territory before this time next year.

Laying their eggs as they do, in so many and in such inaccessible places, often on the tops of mountains, it is impracticable to apply any preventive measures to them in that stage. Since, as Mr. Daugherty, before quoted, says, "they show especial activity, good health, and bad morals," the prospect of being able to check their increase by the introduction of contagious or infectious diseases among them, as my friend Chancellor Snow, of Kansas, has been able to do among the chinch bugs of that State, seems quite remote. Since they move in such vast bodies and have such cannibalistic tendencies, being disposed to feast upon one another when other food is short, it would not be difficult to inoculate them if the proper virus could be found for the purpose.

The best preventive measure that I have seen applied is to fence them out. This is easily done.

A board 6 inches or more in width placed on edge and provided with a strip of tin bent to an angle, and projecting outward from the top of the board, will effectually exclude the insects from the field if they are not allowed to find holes under, or defects in the construction, by which they can find passages through the fence. They will not jump over 6 inches. They may crawl up the side of the board until they come to the overhanging tin caps, when they fall to the ground, but can not cross. Often they will accumulate in such heaps as to form bridges higher than the fence and the advancing forces will cross over on the

bodies of their fellows. This must be carefully watched and guarded against, as well as the accumulation of weeds, sticks, or other trash along the outside of the field. If the ground next to the fence and for 8 or 10 feet outside is made smooth and level, and a harrow, plank drag, field roller, or any other apparatus that will kill the crickets, be drawn at intervals of from one to three or four times a day over the wriggling mass along the border, thousands would be killed and injured, which the others will proceed to devour in short order.

This has been tried with very satisfactory results by the Orchard Farms Company at Bisuka and by farmers near Bellvue and at other places.

Some success has been had in herding and driving them off, causing them to pass to one side of a farm coming in the line of their march, but the plan is not so successful, as it takes a large force and occupies several days and is only applicable early in the season while the crickets are young and active, since, when they acquire their full growth and begin egg laying they are more sluggish and travel much slower.

THE PRESENT STATUS OF THE RECENT AUSTRALIAN IMPORTATIONS.

(Reports of investigations made under instructions from the Entomologist.)

A.—REPORT BY D. W. COQUILLETT.

On the 1st of August I examined the lemon and orange trees in the grove of Col. J. R. Dobbins, where about one dozen specimens of *Orcus chalybeus* were placed in July, 1892, but found no trace of this insect in any of its stages. I learned from Col. Dobbins that a short time after placing the insects on one of the trees they disappeared, and he had not seen a trace of them since that time.

I next visited the orange and lemon grove of Mr. A. Scott Chapman, at which place about 150 specimens of *Orcus chalybeus* were liberated in the month of July, 1892, but a careful examination of a large number of the trees failed to reveal a single specimen of this insect in any of its stages. Mr. Chapman informed me that his experience with these insects was the same as that of Col. Dobbins; the insects disappearing shortly after being liberated and no trace of them having been found since that time.

The following day I examined the orchards in Orange County, where some of the imported insects had been liberated. Mr. H. K. Snow, of Tustin, had received and liberated on one of his orange trees about forty specimens of *Orcus chalybeus* and two of *Leis conformis*; this was in February, 1892, but I was unable to find a trace of them after a long search. Mr. S. W. Preble had received and liberated several specimens of *Orcus chalybeus* in February, 1892, but not a trace of them could be

found at the time of my visit. Both of these gentlemen informed me that the insects disappeared shortly after they were placed upon the trees, and not a trace of them had since been seen.

I next visited the orchard grove of Mr. Hiram Hamilton, near Orange.

Two colonies of *Orcus chalybeus* had been received by Mr. Hamilton; the first colony was received in February, 1892, and consisted of about half a dozen specimens; the second reached him in July of the same year and comprised about seventy specimens. A careful examination which I made of the tree upon which these insects had been placed, as well as a large number of the adjoining trees, failed to disclose a single specimen of this lady-bird in any of its stages. Mr. Hamilton's experience with these lady-birds was similar to that of the persons mentioned above. Last season it was reported that these lady-birds were breeding, and that their eggs had been found on the tree upon which this colony had been placed a few days previously, but an examination that I made of these supposed eggs of *Orcus chalybeus* proved that they were in reality those of one of our native lady-birds—either *Hippodamia convergens* or *H. ambigua*.

It will thus be seen that of the five colonies of *Orcus chalybeus* above mentioned, sent out by the secretary of the California State Board of Horticulture, not a trace can be found at the present time. Of course some of them may appear again at some future time. The fact that two of these colonies contained seventy and one hundred and fifty specimens, respectively, indicates how very difficult it is to establish a colony of these beneficial insects.

The colony of *Orcus chalybeus*, which I placed on a lemon tree in the grove then owned by Mr. A. F. Kercheval, but which is now the property of Mr. L. M. Kercheval, successfully passed the winter out of doors, unprotected by any other shelter than that afforded by the trees themselves. This colony originally consisted of about 360 specimens, 325 of which were received in January, 8 in February, and 27 in April, 1892. At the present time I would estimate their number at between 1,200 and 1,500 specimens, principally adults, but quite a large number of eggs, there being very few larvæ or pupæ. By far the greater number of specimens occur on the lemon tree, upon which I placed the original colony; on each of the adjacent trees not more than half a dozen of these lady-birds are to be found. To the northward of the original tree they have spread to a distance of about 200 feet; to the eastward, 70 feet; to the southward, 300 feet; and to the westward, 100 feet. Careful and repeated examinations of the trees outside of this limit failed to reveal the presence of this lady-bird upon any of them. I estimate that there are at the present time only about one-third as many red scales (*Aspidiotus aurantii*) upon the original lemon tree as were on it at the time that I placed the first colony of these lady-birds upon it, about nineteen months ago. The tree is about 25 feet high, with a spread of branches of about 20 feet.

A short time ago one of the papers published in Los Angeles contained a very sensational article, stating that this colony of ladybirds had increased at an astonishing rate and had spread all over the orchard. This statement, which came very wide of the mark, naturally caused a commotion among the fruit-growers, and for fear that during my absence they might carry off colonies to place in their own orchards and thus deplete the original colony, I agreed with the Los Angeles County horticultural commissioner, Mr. John Scott, that it would be advisable for the board of supervisors of the said county to employ a man to guard the colony until I could get permission to engage such a person under pay from the United States Division of Entomology. This the supervisors consented to do, and employed for this purpose Mr. John Aerni, who had rented the Kercheval place and who could thus be upon it almost constantly. Upon receiving your letter of 10th instant, authorizing me to employ a person to guard this colony of ladybirds, I at once relieved the supervisors of their charge and employed Mr. Aerni for this purpose.

The colony of *Orcus chalybeus*, which I established in the orange grove of Mr. William Niles in the city of Los Angeles, has not done as well as the one just referred to. This colony originally consisted of about 540 specimens, and was placed upon the orange tree in May, 1892. At the present time it is doubtful if a hundred specimens of these ladybirds in their different stages could be found in this orchard. The conditions appear to be identical with those existing in the Kercheval grove, and it is singular that the present colony has not thrived so well as the one referred to above.

Of the other beneficial insects imported from Australia and liberated in this vicinity I have as yet been unable to find a specimen.* Still, it is quite evident that they are established here, but in such small numbers that it might require many hours searching before even a single specimen could be discovered. This is the case with the Dipterous parasite of the Icerya, which was imported under your directions in the winter of 1888–'89. It is very rarely that a specimen of this parasite can be found. Last spring a small colony of them was found in the eastern part of this city, and a few weeks ago I found a single specimen in a widely separated locality. So we may reasonably expect that in the course of time these recently imported beneficial insects will also put in their appearance.

B.—REPORT BY ALBERT KOEBELE.

I left San Francisco by steamer for Santa Barbara on August 14 and arrived at the latter place on the evening of the following day. Mr. Alexander Craw, of the State board of horticulture, arrived the same evening, with the intention of inspecting the bugs at Mr. Cooper's

---

* It is necessary in this connection, in order to account for apparent discrepancies, to state that Mr. Coquillett was unable to obtain admission to the Santa Barbara orchard of Mr. E. Cooper.—Eds.

ranch, and together we proceeded to that place the following day, arriving in time to spend about two hours in examining the orchards where a number of Australian insects had been liberated last year. I had visited the place during September of last year and all the four species above-mentioned were found breeding upon *Lecanium oleæ* upon olive trees. At this visit but three of the species were met with, *Orcus chalybeus*, which was abundant last year, was, strange to say, not observed at all.

Orcus australasiæ Boisd.

This was present in large numbers at Mr. Cooper's ranch, and was feeding upon the Olive Scale. The species is well established at this place, having spread over a large field, and might be introduced upon the Red Scale with good results. The colonies we have had at Alameda and Hayward's last year appear to have perished. Large numbers of their larvæ were present at the beginning of this year at both places. In my yard at Alameda they fed upon the Pernicious Scale (*Aspidiotus perniciosus*), and larvæ of the second brood were noticed up to the end of February, 1893, after which all traces of the insect were lost. At Hayward's larvæ were noticed in numbers during November, 1892, from beetles liberated in August. Here also I am unable to find any traces of them at present. I have, through private correspondence, received this insect again this spring from Australia, and from these I have larvæ of all sizes at present feeding upon *A. perniciosus* and *A camelliæ* (= *A. rapax*) and a number have assumed the pupa state.

Orcus chalybeus Boisd.

The colony at Los Angeles upon the Red Scale is doing well, but I expected to see them in larger numbers from the conditions observed during September of last year. At Mr. Cooper's place, where the same insect was breeding so nicely during September, 1892, upon the Olive Scale, not a trace could be discovered during the two hours at my disposal. I never expected to see this beetle breed upon Lecanium in this country, as in no instance were they observed doing so in their native home. It would be still more curious, however, if this insect, after breeding so successfully during one season upon *Lecanium oleæ*, and having increased to such large numbers as it had, should entirely disappear. The probabilities are that the insect is still present in the orchard, and that before long they will be noticed again at their beneficial work. In Australia the insect is doing remarkably good work in freeing the trees of Red Scale, while on myrtle it is also rarely found feeding upon *Chionaspis eugeniæ* Mask.

Rhizobius ventralis Er.

On my visit to Santa Barbara during September of last year, I found this insect on the increase, and expected that they would soon become numerous. I have been more than pleased, on this last visit, to find

that the beetles can now be found by the millions. The first orchard visited was the one in which the first beetles received by Mr. Cooper were liberated upon 49 trees reserved in the center of the orchard. At that time those trees were all black and covered with Lecanium, but now they are free of scales. The rest of the orchard had been sprayed last year with kerosene emulsion, but the trees have again become full of Coccids. The beetles are present in such numbers, however, that it will be but a few weeks until the whole orchard will be clean. The upper orchard, where beetles were liberated at the end of May of last year, is practically free of scales, and from here the Rhizobius have spread to the central orchard and can be found by the hundreds upon every tree. The beetles were seen in copulation everywhere, and on nearly every branch the females were seen thrusting their eggs under the old scales. It will be but a very short time until every tree is clean of scales, and no time should be lost in collecting and distributing this valuable insect to all parts of the State. Mr. Cooper informs me that he has already sent out several colonies and I took occasion to visit a prune orchard near San José infested with *L. oleæ*, where a colony of these beetles was placed on July 31. The mature beetles were still present, and their larvæ, up to about half grown, quite numerous. This, in fact, is the second colony set out, the first being liberated on June 29, and beetles could still be seen when the second lot received from Mr. Cooper were liberated. I have not seen the first colony, but have not the slightest doubt that this also is on the increase. This beetle is one of the most common Coccinellids in Australia, preying chiefly upon Eriococcus, Rhizococcus, and various Lecaniinæ, and upon these last it could always be found in New South Wales on my last trip. On my first trip I forwarded this insect to Los Angeles from South Australia and Victoria, where it was erroneously supposed to feed upon Icerya. Within two years at the longest I believe that the various Lecanii in California (and Florida as well) will have succumbed to the ferocity of this little beetle.

Rhizobius debilis Blackb.

A year ago this beetle could be found nearly as numerously as the foregoing at Mr. Cooper's ranch, but at the present time they are by no means so abundant. *R. ventralis* has increased so rapidly that this species, in effect, is lost among the vastly greater numbers of the other species, and there seems little likelihood of this species maintaining itself at this place. It is this species that keeps the olive trees practically free from black scales (*Lecanium cassiniæ*) around Adelaide, South Australia, and I have always found the two species working in harmony upon Lecanium in New South Wales. The enormous increase of the one species and the decrease of the other here is no proof that the latter insect is of less value, and if *R. debilis* had outnumbered *R. ventralis* at the beginning we should probably now see things reversed.

It would be a good idea to gather the first-named species and colonize it somewhere by itself. With me the species has bred all along upon the Pernicious Scale, larvæ being observed all winter and up to April, when I left for Oregon. At present the larvæ are still found upon the same trees, but how many of the beetles are left I can not well say. The insect should be introduced upon *Aspidiotus aurantii*, upon which, without doubt, they will feed to some extent, at least as well as they do upon *A. nerii* in Australia.

Rhizobius satellus Blackb.

I was greatly disappointed in not meeting with this insect upon the Red Scale in any of the places where colonies had been liberated. The beetles were sent to Los Angeles by the thousands, as well as also to Mr. Lelong, and they may yet appear at some of the numerous localities where they were liberated. This is the most abundant Coccinellid preying upon the Red Scale in Australia, and since it is a continuous breeder, it should not take long to become numerous with us. I have attempted ever since my return to obtain specimens from Australia to introduce upon this scale, but so far have not succeeded.

Thalpochares cocciphaga Meyrick.

I have not learned whether this insect has been established upon Lecanium with us. The Hon. Ellwood Cooper liberated a very large number, and they should have established themselves at his place, if anywhere, yet Mr. Cooper has never seen any trace of them. At present there is very slight chance of this moth breeding at this place, since the scales are disappearing rapidly before the vast army of Rhizobius. At Haywards, Alameda County, where also a large number of the moths were liberated, both by the State board and by myself, and where the conditions are very favorable, I am also unable to find any trace of them, although they may be present.

ON THE INJURIOUS AND OTHER LOCUSTS OF NEW MEXICO AND ARIZONA.

By C. H. Tyler Townsend, *Kingston, Jamaica.*

A lot of locusts (Acridiidæ) has recently been determined for me by Prof. Lawrence Bruner, which enables me to present the following notes on thirty-five species. These were collected by the writer in New Mexico and Arizona, mostly during the summer of 1892, except five species from the collection of Hon. W. G. Rich, ex-secretary of this Territory. A few mesa forms occur among the following species, but most of the number are more or less injurious to cultivated crops, especially cereals and forage plants; or to native grasses, which latter

are of much importance to the Territory, since they form the main support of the cattle on our ranges. The grasses of the mountain valleys and plains of New Mexico consist principally of the common Gramma Grass (*Bouteloua oligostachya*), together with *Stipa comata* and *Aristida purpurea*.

Acridium emarginatum Uhl.—Las Cruces, August 19. ♀. Another ♀ specimen which I take to be this species, but which has the tegmina much less yellowish on sides, was taken in the Grand Canon, July 10.

Acridium shoshone Thos.—Chaves, N. Mex., August 6. ♀. Las Cruces, October 24, ♂ in alfalfa field. A ♀ taken in the Crand Canon, July 10, is slightly yellower. This species often defoliates the Mesquite near Las Cruces (see *Canad. Entom.*, 1892, p. 198).

Arphia tenebrosa Scudd.—This is a very black species with wings on oblique basal, half bright red. Sept., Las Cruces.

Arphia teporata Scudd.—Las Cruces. May 9. In alfalfa fields. Not particularly numerous.

Aulocara elliottii Thos.—Very abundant in Johnson's Basin, western Socorro County, June 22, on the short native grass which grows in the valley. It occurred in large numbers and caused considerable injury to the grass. This was in 1892. *Melanoplus occidentalis* occurred with it, and a specimen of *Camnula pellucida* was also taken. On June 23 (next day) it was found abundant farther west in valleys on the Springerville road, in New Mexico, near the Arizona line. At Pratt's ranch, just across the line in Arizona, we were told that these locusts had destroyed the garden and field crops there the previous year (1891), and had eaten up the grain fields for three consecutive years (1889 to 1891, inclusive). The ranchmen had concluded to try it another year, for the fields were in grain at that time. The abundance of the locusts at that date, June 22–23, indicated that the crops would probably be destroyed for the fourth consecutive year. On July 31, 1892, I was told at Ramah, a small Mormon settlement east of Zuni, in New Mexico, that for the four years previous the locusts had eaten up the wheat crop in that vicinity. The alfalfa crop had also been repeatedly destroyed. The description given me indicated the above species, and probably *Melanoplus occidentalis*. *Camnula pellucida* was very probably associated with them.

Aulocara scudderi Bruner.—Chaves, New Mexico, August 6. ♀.

Bootettix argentatus Bruner.—This beautiful species I have found only on Larrea. Young, May 13; adults, July 17. Las Cruces (see Can. Ent. 1892, p. 198.)

Camnula pellucida Scudd.—In swarms in the fields and along roadsides at the AI ranch of the Arizona Cattle Company, 9 miles from Flagstaff, Ariz., near the San Francisco mountain, July 16, 1892. Both sexes. A ♂ specimen is paler and quite greenish instead of brownish. A small ♂, much paler than the other specimens, was taken in Johnson's Basin, N. Mex., June 22, along with *Aulocara elliottii* and *Melanoplus occidentalis* mentioned above. Also a ♂ from the Continental Divide, in Valencia County, N. Mex., August 2.

Circotettix shastanus Bruner (?).—Flagstaff, Ariz. Common near town, and especially so just at the north of it. July 3 to 16. This is a blackish locust, which stridulates more shrilly in the hot sun than any species I have ever had the pleasure of listening to.

Conozoa texana Bruner.—Las Cruces, May 19 and September 2. Both sexes. Rather common.

Dactylotum longipennis Bruner MSS.—Grand Canon, 3,000 to 5,000 feet below rim at Hance's, July 9–10. This is a beautiful species, marked with bright red on the head, from which a median red vitta extends down the pronotum, with red on pleura and on abdomen near extremity. Wings light green, rest more or less yellowish. Hind tibiæ bluish.

Dactylotum variegatum Scudd.—A number of specimens collected by W. J. Howard

in Grant County, N. Mex., in 1882. Collection of Hon. W. G. Rich. This is a variegated, orange red, yellow and green painted species with short wings.

Dissosteira carolina Linn.—Collected by W. J. Howard in Grant County, N. Mex., in 1882. Coll. Rich.

Encoptolophus costalis Scudd. (?)—Las Cruces, May 8 to 12. In alfalfa fields. Both sexes. Very plentiful, especially along dry acequias through alfalfa.

Haldemannia tschivarensis Hald.—A ♀ pupa, lubber-like, with greatly developed thorax, was taken on mesa in spring. Las Cruces.

Hesperotettix montanus Riley MSS.—Chaves, N. Mex., August 6. ♂ This species may be recognized by its slender shape, greenish color, reddish hind femora, and bluish hind tibiæ; pronotum with two narrow black median vittæ, and one shorter lateral vitta.

Leprus wheeleri Thos.—A pale brownish species with bluish hind wings and tergum. Collected by W. J Howard in Grant County, N. Mex., in 1882. Coll. Rich.

Melanoplus bowditchi Scudd.—Chaves, N. Mex., August 6. Both sexes. A ♂ which I take to be the same species was collected at Sabinal, N. Mex., August 7. A ♀, Belen, N. Mex., August 7. Common. Some specimens vary in being quite yellowish, especially on the head.

Melanoplus femur-rubrum De G.—Chaves, N. Mex., August 6. Uncommon.

Melanoplus herbaceus Bruner—A single ♂. Las Cruces. Wholly very pale greenish in color.

Melanoplus occidentalis Thos.—Two ♂'s, Johnson's Basin, N. Mex., June 22.

Mermiria bivittata Serv.—Sabinal, N. Mex., August 7. Several females and many males. Only on *Aster spinosus*. The ♀ is very much larger than the ♂, two or three times as large. A ♀ was taken in Las Cruces, August 19. This is a very elegant slender species, especially so in the ♂.

Ochrilidia occipitalis Thos.—A ♂, Johnson's Basin, N. Mex., June 22. A ♀, Holbrook, Ariz., June 27. The ♀ is more reddish than the male specimen.

Paratettix mexicanus Sauss.—Grand Canyon, 3,000 to 5,000 feet below rim at Hance's, July 10.

Paratettix toltecus Sauss.—Grand Canyon, July 11. ♂ ♀. Four thousand to 5,000 feet below rim at Hance's. The ♀ differs from the ♂ by having four black spots on the prolongation of pronotum, the two anterior ones largest, opposite, one on outer edge at each side; the two posterior ones small, and on crest in median line.

Psolœssa (?) *maculipennis* Scudd.—A single ♂, Johnson's Basin, N. Mex., June 22. Grayish brown, tegmina marked with black on sides, hind tibiæ red.

Spharagemon balteatum Scudd. (?)—Chaves, N. Mex., August 6. A single ♀.

Syrbula montezuma Sauss. (?).—Grand Canyon. ♂ ♀. Four thousand to 5,000 feet below rim at Hance's. July 9–10. This is a slender species, much resembling *Mermiria bivittata*, but smaller.

Tæniopoda picticornis Wlk.—A large lubber-like black species, with orange-colored pronotal crest or ridge. Collected by W. J. Howard in Grant County, N. Mex., in 1882. Coll. Rich.

Thrincus aridus Bruner.—Las Cruces, ♂ ♀. One specimen taken May 18 has a very bleached appearance, and is determined doubtfully as this species.

Trimerotropis cœruleipes Scudd.—Turkey Tanks, Ariz., July 17. ♂ ♀.

Trimerotropis vinculata Scudd.—Las Cruces. This species was found in numbers in north end of Organ Mountains, November 26, 1892. A pair was taken there *in coitu* on that date.

Tropidolophus formosus Say.—This is a green species, mottled with brownish, with a remarkably crested pronotum and abbreviated wings in the ♀. The ♂ has orange-red wings. Collected by W. J. Howard in Grant County, N. Mex., in 1882. Coll. Rich.

Xanthippus zapotecus Sauss.—A ♀, Johnson's Basin, N. Mex., June 23. A much larger ♀, nearly one-fourth longer, captured on the Jornada del Muerte, to the north

of Las Cruces. This is the shortest flying Acridiid, I believe, that we have in this region.

The above thirty-five species represent twenty-five genera.

EXTRACTS FROM CORRESPONDENCE.

The Corn-Root Plant-Louse.

I inclose for your inspection a stalk of maize. It has now upon its roots quite a number of small greenish insects from the size of a pin-head to smaller; also several small common black ants. You will observe the plant is in a languishing condition, in fact it is not so large as it was a week ago. There is quite a large acreage of corn in this county (Montgomery) so affected. My crop, or a portion of it, was damaged fully 50 per cent last year by the same insect.—[E. P. Thomas, Md., June 27, 1893.

REPLY.—The insect which is found upon the roots of your corn is the common Corn-root Plant-louse (*Aphis maidi-radicis*) and the ant is the common and widespread species known as *Lasius aliena*. The plant-louse is almost entirely dependent for its existence upon the care taken of it by the ants. It seems, in fact, to pass the winter only in the nests of this particular ant. It feeds early in the spring upon the roots of the smartweed (*Polygonum persicaria*) and may also live for a short time upon the roots of pigeon grass (Setaria). Its main food plant, however, is corn. The winged generation appears early in the spring and by this means the species is dispersed. Were it not for this fact, rotation of crops would be an almost perfect remedy. It is, in fact, a remedy of secondary importance, even with the dispersal of the species by the winged brood, and continuous cropping of the same fields with corn affords the best conditions for the increase of the root-louse. There are no actual remedies which are applicable at the present time, but a great deal may be done towards lessening the numbers of the insects the coming season. Late fall plowing and harrowing by removing the old cornstalks and breaking up the nests of the ants after these have become dormant for the winter, a thorough stirring of the soil with disk harrows in the early spring to keep down the sprouting herbage, or any treatment of the field in the fall which will keep down the smartweed and pigeon grass will bring about a beneficial result.—[June 29, 1893.]

Destructive Locusts in Colorado.

* * * As near as I can determine the grasshoppers that have been working here are the natives. They have hatched out from quite early until within a few days. There have been all sizes of them from the most minute to the full grown. So far they have done but little toward depositing their eggs. Our experience here may do some good to others. First we used a sled 14 to 16 feet long, with boxes like your Pl. 8, Fig. 1. This was filled with limewater. A great many were killed this way. Then they took about the same machine, only made out of iron or tin, and used water with coal oil. Then the same thing was used with coal tar and oil. This was the most effectual, though more costly. Some farmers caught as high as 200 bushels of them. Last, but by no means least, is the bran and Paris green mixture, which they like better than any growing crop, and which slays them by the thousands. The mixture they are using here is 100 parts of bran, 3 parts of Paris green, and some old molasses or other cheap sweet substance to make it stick together. Probably two quarts to the 100 parts bran will be enough. This is strewn along between the rows of potatoes or corn or through the alfalfa fields. The hoppers will leave all other food for it. If there is water they can get to drink near by they die very fast; otherwise, it is several hours before they will give up. It is estimated that

20 per cent of the crops have been damaged by them. In some localities 50 to 75 per cent have been entirely destroyed. We think that for this year their damage is mostly done. The thing now is to head them off for another year. Farmers are still setting out poison and are bound to kill off as many as possible, so as to lessen the number of eggs laid. Plowing and late irrigation will be done.—[H. B. Jackson, Colo., August 15, 1892.

Locusts in Colorado—Another case.

Recently, while in Colorado, I incidentally visited Grand Junction, at the request of the board of trade of that town, to look into a grasshopper or locust plague that has been present in that valley for the past three years. I herewith send you a brief report of conditions as they were found:

About four years ago it was noticed that grasshoppers were unusually abundant on a piece of waste land near the river south of the town of Fruita, which is situated on Salt Lake Western Railroad, about 12 miles west of Grand Junction. The next year these hoppers spread to several of the surrounding farms, where they did some damage to crops and orchards. The next year these hoppers had increased to such an extent that they did considerable injury to both crops and orchards. In fact, they did many thousands of dollars' worth of injury to the peach orchards, which thrive here as nowhere else. One orchard alone is reported to have suffered to the extent of $25,000. This orchard was visited by me, and as it is 80 acres in extent and was fully half destroyed I do not doubt that the injury was fully this great. A great many other orchards, both large and small, were more or less completely destroyed by these insects last year. With all this amount of injury going on about them the inhabitants did but little fighting, and what fighting they did do was undertaken so late in the year that it did comparatively little good. The warfare did not begin until after the hoppers had attained their growth and were winged. At this time they had left the grain fields and were most, if not all of them, in the trees composing the various orchards of the region. Here they remained upon the twigs and branches feeding upon the leaves and tender bark of the new growth. When here it was next to impossible to dislodge the pest and get at it. Some bran and arsenic was used, but so carelessly in many instances that not only were domestic fowls and an occasional larger animal, but also nearly all of the native birds of the region, destroyed. Only one good feature of the use of this remedy was the destruction of many rabbits.

This year I chanced to visit the region about a week before the mass of hoppers concerned in this destruction had attained their growth, and was, therefore, in time to do some good for the inhabitants by suggesting a more profitable and at the same time practical method of warfare, viz, the use of the hopper dozer or kerosene pan. In driving over the region for several days prior to my suggesting a definite remedy it was ascertained that the majority of the locusts were confined to the edges of alfalfa and grain fields, or else they were to be found in the rank vegetation along the edges of irrigating ditches. In these localities it was observed that the most practical remedy that could possibly be brought against them was the "dozers." Accordingly several of these machines were ordered made and several meetings of the farmers of the region were planned. At these meetings addresses were delivered outlining the various methods that have been and that might be used in fighting locust pests. Both the practical (such remedies as can be applied with a saving) and the impractical (such as cost more to apply than would be the value of the crop intended to be saved) remedies were described at some length. In the case under consideration, where the people were not overburdened with cash, I insisted upon the *practical* remedies, although there were many among the audiences who insisted upon some remedy where there was to be little or no outlay of labor.

Prior to my arrival in the valley the citizens of Grand Junction sent to the Colorado oil region at Florence and secured a 1,000-gallon tank of crude petroleum oil for use in destroying the 'hoppers. This, I ascertained, it was intended to use by pouring it into the irrigating ditches, and in that manner spread it over the country. In my address I insisted that this would only be wasting the material and destroying the vegetation wherever the oil reached, and that the 'hoppers would be mostly all left unhurt. We tried the oil in the "hopper dozers" and were surprised at the results. It worked much better than the refined oil does, and its cost was so very much less, being only 4 cents per gallon delivered at Grand Junction.

There are several species of locust concerned in these injuries in and about Grand Junction. I found *Melanoplus atlanis*, *M. bivittatus*, and *M. differentialis*. There were also several other species of locusts that were very numerous in the valley. One of these was what appears to be an undescribed species of *Pezotettix*, bearing some resemblance to *M. turnbulli*, only with very short and narrow tegmina. Like that insect, this *Pezotettix* also seems to confine its attention almost entirely to the various species of Chenopodiaceæ, of which there are quite a number of forms common to the region. It is especially fond of the grease-wood (*Sarcobates vermicularis*). Peculiarly enough was the fact that on my arrival in the valley all the plans that were then under way were for the destruction of this "native" species of *Pezotettix* that did none or very little of the injury that had thus far occurred in the region.

If the instructions which I gave and insisted upon being carried out be followed by this time the valley could be practically free from this pest. I would also state that aside from the price paid for labor the cost for this extermination would not be above a couple of thousand dollars; while, if nothing be done, there are or were hoppers enough in the valley to destroy a half million dollars' worth of crops and trees. Last year the pest might have been handled for even less than this amount, and the $200,000 and more of injury that was sustained might have been saved. I even went so far in my remarks as to state that if one-tenth of the amount lost on the one orchard referred to above had been properly expended at the right time last year there would have been no need of worry and fighting the present year, and nearly all the loss sustained might have been avoided.—[L. Bruner, Nebraska, July 10, 1893.

A Peculiar Gad-fly.

I inclose sample of a species of Tabanus that is very annoying to stock after sundown. They do not appear during the day, except rarely on very dark days, but in June and the early part of July they swarm upon cattle and horses after sunset and render them well-nigh frantic in their efforts to escape. As soon as darkness comes on, or say about half-past eight now, all the flies disappear. One hour each evening is about the extent of their feeding time, and as they all come at once they make lively times in the cowyard. Milk cows, etc., can be protected by stabling in dark place every evening, but this is impracticable with herds in pasture.—[G. M. Dodge, Missouri, June 18, 1893.

REPLY.—* * * Your account of the habits of the species which you send—*Tabanus tectus*—is very interesting. Can you not ascertain the breeding habits? You have a good chance to try the effect of fish oil and other repellants which act fairly well against the Horn Fly. I should be interested to know whether they will keep off the gadflies.—[June 21, 1893.

SECOND LETTER.—*Tabanus tectus* is now nearly gone. I got one specimen to-night at about 8 p. m., considerably worn. Saw no others. It usually lasts about one month, and is single brooded. I did not learn its breeding habits.

As advised in your letter I tried fish oil as a preventive. Mixed it with bacon fat and put it on in the evening, when the flies were most plenty, which was about 8 o'clock. It seemed to have no effect. The flies would alight and draw blood where the hair was shining with grease. There were but one or two cows in the herd that

it could be tried on satisfactorily because the most of them would do their best to fight the flies off. Only once did I see a fly foiled by the grease. It alighted on a very greasy place and moved twice, trying to insert its proboscis, and then let go and fell toward the ground. It was so dark that I could not tell whether it was smothered by the oil or whether it flew away.

The oil that I used may not be the best. I had been using it for horn flies, and it only affords protection about one day. I tried it for gadflies on three evenings.

There are a great many species of gadflies here; more than I ever saw elsewhere. But none are abundant except *tectus*, and no others are nocturnal in their habits, or perhaps I should say crepuscular, as *tectus* remains only while twilight lasts.—[G. M. Dodge, Missouri, July 26, 1893.

REPLY.—* * * I am surprised about the nonsuccess of the fish oil, the more so as you state that it will only keep the flies off for one day. A recently published bulletin of the Louisiana Experiment Station states that the fish-oil emulsion will protect stock for four or five days. It may be that your oil was not good, or perhaps that emulsifying it increases its effect. I should think that it would make it more lasting.—[July 31, 1893.

Termites Swarming in Houses.

* * * An insect resembling an ant appears to have taken up its permanent home with me. They come out only in the spring, remain for a period of two or three weeks and then disappear to be seen no more until the following year. So for ten years, their habitation appears to be near the kitchen range around which they first appear; as time passes they leave that locality and strive to leave by the west window—some ten feet away. They are in such considerable quantities as to become a pest at times. A cupful at a time nearly, has been found.—[Edwin M. Truall, Washington, D. C., June 3, 1893.

REPLY.—The insects which are swarming in your house, although so closely resembling true ants, are representatives of a different order and are closely related to the remarkable white ants or "termites" of Africa. The insect is known scientifically as *Termes flavipes* and the early stages are passed in dead and usually more or less decayed wood. It is found in stumps and old logs and inhabits the timbers of many houses and other buildings in this city which have been erected for some years. The larvæ burrow in the timbers but fortunately take a longitudinal direction and never sever the main fibres, so that the timber may be pretty well riddled by them and still retain a great proportion of its sustaining strength. In the course of years, however, it must become considerably weakened. The probabilities are that some of the joists in the walls or under the floors of your kitchen are infested by these insects which become full grown in the spring and attain wings. The winged individuals may be destroyed by insect powder, but the annual flight will continue until the colony is destroyed. This can only be done by either renewing the timbers or by injecting a quantity of kerosene into the burrows, which, of course, must first be discovered and uncovered.—[June 3, 1893.]

Carbolic Acid for Rose Chafers.

I have been spending considerable time and material on the rose bug or Rose Chafer, as it has been our worst enemy on our grape tracts, endeavoring to find some remedy and have succeeded at last. Nothing among our poisons will kill them except one article, and that is crude carbolic acid; they can not live ten seconds put into it, and 1 gallon of acid to 100 gallons of water will clean them from fruit trees or grape vines and not injure fruit or foliage. I found this out by experimenting when they were abundant this year, and procured a horse-power spraying machine and went over 23 acres that were covered with them and cleaned them out. This was about the 18th of June when the grapes were in blossom, and only one applica-

tion was made. My cherries were saved in the same way. This is a cheap remedy and a sure shot for them.—[S. Justus, Ohio, July 10, 1893.

REPLY—The Entomologist reports that while he is hardly willing to admit that the result of your single experiment proves the efficacy of carbolic acid, he is, nevertheless, greatly pleased at its success and when opportunity offers he will conduct further experiments in the same line.—[July 13, 1893.]

Abundance of Tent Caterpillars.

The Apple-tree Tent-caterpillar (*Clisiocampa americana* Harr.) seems to have its own way in the town of Andover and portions of Lawrence. Nearly every tree is covered with them. The farmers do not molest them and I have been informed that they have not done so for a number of years past, and of course the caterpillars are getting worse every year. I collected some of the larvæ and I find that some of them are parasitized by the Tachina flies and some with Ichneumons.—[Geo. B. King, Mass., July 3, 1893.

An Alfalfa Worm in Wyoming.

During the last week of May an "army" of worms appeared upon the young alfalfa on the McConnell ranch, near Jetsam. In a few days the greater part of 80 acres of alfalfa looked as if scorched by fire. As soon as the damage was noticed the work of irrigation was hurried and the ground flooded as fast as possible. Wherever it was possible to cover the ground with water the worms were destroyed. Uneven ground where water could not be run had to be left to the birds. Black birds, larks, and American robins were especially active. Three weeks would cover the entire time of the irrigation. The worms after abandoning the alfalfa continued their work upon wild sunflower and a few other plants along the banks of the ditches and laterals, working in the same manner as upon the alfalfa by webbing up the plant, and then eating the leaves. It is not usual for these worms to attack alfalfa. It may perhaps be explained by the fact that other vegetation is rather scarce owing to extremely dry weather.—[E. G. Lamberson, Wyoming, June 29, 1893.

NOTE.—The alfalfa worm is the larvæ of a species of Loxostege nearly allied to *L. sticticalis* which damaged sugar beets in Nebraska during 1892.

Tansy and the Plum Curculio

I am reminded by the inquiry of G. L. F. in *Scientific American* of to-day's date—page 45, paragraph 5186—of the perfect protection from insect attacks afforded a wild plum tree transplanted from the woods into my father's garden more than fifty years ago, by a clump of tansy growing all about the tree trunk. Plums ripening about a bed of tansy will not be found stung, but coated with a sort of "frosting" quite bitter to the taste, a bloom such as covers the skin of the grape. [G. W. Devin, Iowa, July 15, 1893.

REPLY.—I have heard of this protection of plum trees by tansy and have referred to it in some of my writings on the Plum Curculio, but heretofore have always been more or less skeptical in regard to the matter.—[July 18, 1893.]

A Handsome Blister Beetle.

I inclose under another cover a couple of insects taken upon the top of Short Off Mountain, at an elevation of about 5,000 feet above sea level. They are found feeding upon *Robinia viscosa*; were quite plentiful. The gentleman who was with me says that a few days before he saw immense quantities of them upon Whitesides at about the same elevation where they had nearly, if not quite, denuded the *Robinia viscosa* of its foliage. Have not observed them yet at a lower elevation. What are

they and what will be the best method of destroying them should they attack any ornamental or fruit trees or other crops?—[James B. Smith, N. C., July 3, 1893.

REPLY.—* * * The beetles which you send are specimens of a very handsome species of Blister Beetle, the scientific name of which is *Pomphopœa unguicularis.* This species occurs in such numbers rather rarely, and your observation is interesting. Should they attack ornamental or fruit trees, or other crops at a lower elevation, you will be able to destroy them by applying Paris green or London purple in the proportion of one-fourth pound to 40 gallons of water.—[July 15, 1893.]

Trapping the 12-spotted Melon Beetle.

Maj. M. F. Berry, of Pachuta, Miss., thinks he has discovered a successful trap for this destructive beetle. It is simply an old gourd. All the gourds of last year lying about are utilized. He cuts holes in the gourds not larger than may be stopped by a large corncob, and after removing a part of the seed and old pulp, places them about the spots most frequented by the enemy. These traps seem wonderfully attractive to the beetles. I have seen as many as 40 taken out of one small gourd, and that twice a day. To kill them, after catching, is a trouble. So far he has found hot water effective. Wetting the inside of the gourd seem to render it more attractive to the insects. For garden practice, nothing more could be desired. But for a large cornfield now, it would require a great many gourds, and be very laborious collecting them twice a day, or even once. It might be well to try a few drops carbon bisulphide. Any plan that destroys, or seriously diminishes, these Pests is worth knowing. They have caused the crop to be planted over again a second and third time in places; and this means a loss of 25 per cent, besides the labor expended.—[Lawrence C. Johnson, Mississippi, June 15, 1893.

Tasmanian Insects.

Our principal troubles here, in the order of their severity, are: The Fusicladium, Codling Moth, Army Worm, and undergound Grape Grub, Mussel Scale, and American Blight (Schizoneura). I have carefully experimented with the Fusicladium, and my best results have been attained by the use of the Bordeaux mixture and kerosene emulsion, with 1 to 20 of copper sulphate. It is worthy of note that one variety of apple escapes, the true Adam's Pearmain, a tall, flat-crowned apple. As regards the Codling Moth, there are already fruit boards in all parts of the colony, with inspectors, etc., and I can do but little else but advise, as they are unfortunately not under the control of my department, the council of agriculture. I can, at least, say that when reasonable care has been taken in picking off the infested fruit, and also in spraying once or twice with Paris green or London purple, the moth has been very considerably reduced, and in some places completely exterminated. Our chief trouble in this respect arises from the unwillingness of the owners of very small orchards; in other words, those who are not dependent upon them for their living, to carry out the provisions of the act. I am sorry to say that the Cherry Leech is spreading with great rapidity. It is only six years since it first made its appearance from New Zealand, but it is now all over southern Tasmania. I have not succeeded in finding any parasite which attacks it, so we are reduced to the usual treatment of spraying with hellebore, etc., and dusting with lime, ashes, etc. I have reared three parasitic flies from *Lachnosterna fusca,* but they are by no means plentiful. The Wheat Aphis appeared last season, but it was immediately suppressed by a small Microgaster, which has eighteen joints in the antennæ; the wings are veined and are hyaline, while the veins and stigma are light brown. The size is very minute. * * *.—[Edw. H. Thompson, Government Entomologist, Tasmania, April 15, 1893.

The Plum Curculio in Door County, Wis.

Until recently the peninsula lying between Green Bay and Lake Michigan has been free from invasion by the Plum Curculio, *Conotrachelus nenuphar,* and until the

present summer it has never been found in the part of this peninsula lying north of Sturgeon Bay, so far as can be learned from fruit-growers in that region. In consequence of this, plum-growing is becoming an industry of some importance in that district.

Wishing to learn positively the extent to which this part of Wisconsin enjoys immunity from the Plum Curculio, I visited Sturgeon Bay village about the middle of July, and made a careful observation of the Plum and Cherry orchards in the vicinity. North of the bay the most careful search failed to discover a single curculio-infested Plum, though more or less of this fruit is grown on almost every farm and on many village lots. A very few infested cherries were, however, discovered, but in every case the owner of the trees declared that "wormy" cherries had not been known there until the present season. South of the bay the case was different. The plums were more or less infested, especially those lying toward the west side of the peninsula. In several instances the infection had not yet been discovered by the owners of the trees; in others it had been discovered, but all agreed that it was new in that locality. The invasion apparently proceeded from the southwest, as orchards appeared to be affected more on the southwest side than elsewhere.

It is generally agreed by the farmers in the vicinity of Sturgeon Bay that the Pea Weevil, *Bruchus pisi*, is entirely absent from that region, though it is said that it was once present there.—[E. S. Goff, Wisconsin, Aug. 16, 1893.

The Juniper Bark-borer in Nebraska.

I send you a number of specimens of beetles found on one of my red-cedar trees, which are proving to be quite destructive. I have used several emulsions, but have not succeeded in "hitting" them. They bore into the axil of the twig until the twig falls over and dies, and then they fall off. Often they burrow on the outer angle and sometimes cut the twig off above the angle. The same tree from which these are taken was attacked in 1884 by the same beetle. If known, please send me name and remedy.—[R. Harvey, Nebraska, August 14, 1893.

REPLY.—The insect which you send, and which is affecting the red cedar in your vicinity, is known as the Juniper Bark-borer (*Phlœosinus dentatus* Say), a very small insect belonging to the family Scolytidæ. This insect is making its appearance in the West at various points, and has already occasioned considerable loss and destruction to the red cedar in different sections of Kansas and other Western States. Its normal region is included in the Middle States and Eastern States and Canada, where it affects both juniper and arbor vitæ. In Kansas its introduction was traced to certain cedar posts brought to the lumber yards from Michigan and Arkansas, and its introduction into your section was doubtless by similar means. It is found to be attacked by a parasitic fly belonging to the genus Spathius, and it was doubtless the increase of this or other parasites which led to the disappearance of this pest after its first appearance with you in numbers in 1884. It is quite likely that its abundance the present season will again result in a like increase of natural enemies, again reducing its numbers to a minimum. There is no remedy except the rather heroic one of cutting down and destroying all infested trees in the region in which it has become introduced or perhaps by weakening trees by injuring them artificially, so that the beetles will be attracted to these, preferring, as they do, diseased trees to vigorous ones. Later on the treatment is consummated by burning these trap trees.—[August 22, 1893.

Spider Mimicry.

At Jamesburg, N. J., in August, 1893, I found on a small oak tree what was apparently a gall, perfectly formed, growing on the upper surface of a leaf. On handling the leaf for closer inspection the supposed gall rolled off into my hand, leaving the surface of the leaf entirely free from any scar or other indication of the gall's pres-

ence. Turning my attention to the latter I discovered it to be in reality a spider (*Ordgarius cornigerus* Hentz) which had been resting on the leaf, its curiously formed abdomen simulating exactly both in form and color the common oak gall, even to the tiny punctures through which the gall insect makes its exit when mature, a remarkable example of protective mimicry.—[R. S. Lull, Washington, D. C., September 11, 1893.

A new Scale Insect in Florida.

I inclose a piece of wood from plum tree that is covered with a scale which is destroying a large number of peach and plum trees in this section. The tree I cut this piece from was sprayed a few days since with kerosene emulsion—2 pounds whale-oil soap, 4 gallons kerosene, 40 gallons of water. I do not think these scales are killed, even with that, and I have tried pure kerosene and failed to kill all. What is the scale? What is the best way to destroy it? It appeared in my orchard several years since and has killed, or materially damaged, a few trees every year. I find that during the spring and summer they cover the body and larger limbs with a cottony substance, making a complete covering about the head of the tree and extending up on the larger limbs and down the trunk several inches. I have seen trees 5 inches in diameter killed entirely. The bark dies at the head when covered and extends up the limbs and down the body until the whole tree is dead. I discovered a month ago that there was a minute red-bodied fly mixed with the wax or coming out of them. In connection with this cottony stuff I see a black worm covered with spines or hairs. They are about three-sixteenths of an inch long, one-third as thick, and oval in shape. They get completely covered with the cottony stuff, and moving around on the tree look like a white ball.—[S. S. Harvey, Florida September 5, 1893.

Reply.—This sending is of extreme interest, as the species is new to science and has never been written up in print. Curiously enough it appeared suddenly in Washington upon a few young peach trees a little over a year ago. We have been unable to trace the origin of the scale, as these trees were grown from seed, and although a careful search has been made for other infested trees no result has been accomplished. We shall be very glad if you can offer any hints as to its origin with you. It belongs to the genus Diaspis, to which a number of scale insects which are very destructive also belong, notably the Rose and Blackberry Scale (*Diaspis rosæ*). You are correct in supposing that this is the wrong time of the year to spray, since the eggs are at this time protected by the old scale of the female. These eggs will hatch, however, early next spring, and the young unprotected larvæ will migrate to the new growth of the trees. A spraying with kerosene emulsion at that time will destroy these young, and prevent the spread of the species and also further injury to the infested trees. The minute red-bodied flies are the males of the wingless scale-covered females. The cottony stuff is thready wax secreted by the insects. The small black worms covered with spines are the young larvæ of some lady-bird beetle which feeds upon the scale insects.—[September 11, 1893.

The Stink Bush as an Insecticide.

I will now give in detail my experience with the "Stink Bush" and the facts which led me to suspect that it contained insecticides. During the winter of 1870–'71, Mr. F. Hinson, of Harrisville, passed me with a sack full of the leaves from which he made decoction for destroying the lice on a colt. He told me afterwards that it was successful. Mr. W. I. Hilton, of Harrisville, as well as others, used the leaves for the same purpose. This summer I have tested the matter and am to-day satisfied that the leaves possess no insecticide properties. I have made four experiments. The result of the first was given July 1, and I had yours as a check, concerning which I will refer later. The second and third gave negative results. Fresh

leaves and balls were used in all three experiments. The last and fourth was with carefully dried green leaves reduced to a snuff or powder. The decoction or infusion of this last gave negative results also, but revealed a ropy consistency, something like Slippery Elm. For sometime I was greatly perplexed, after receiving your statement that your results did not agree with my first experiments, which had stimulated me so much, but I have decided that the effect on the worms, which was similar to the effect produced by treating with a decoction of tobacco, was really the poisonous effect of nicotine. I used a vessel in which I had made a previous decoction of tobacco, and merely rinsed it out, and boiling the leaves and balls in it, of course, brought out all the adhering strength and produced results as stated. Or, possibly, this gum closed up the breathing pores, which should have been the case with your experiments also, if true, but this even would not have produced the spasmodic symptoms so characteristic of tobacco poison. Be this as it may, I have no faith in it as an insecticide.—[S. B. Mullen, Mississippi, September 1, 1893.

Alleged Killing of a Dog by the "Hickory Horned Devil."

I express you this day a worm, which I would like you to examine and give me name, etc. This bug was brought to this place by a negro who lives near here, and his story is that his dog went into a patch of weeds near his house, and yelping as if in pain ran out with this bug fastened to his lip by one of its horns. The dog lived about an hour and then died, with symptoms of hydrophobia; at any rate, it had fits of that character. The weed patch, which was small, was examined for a snake, but none could be found.—[T. R. McGuire, Mississippi, September 8, 1893.

Reply.—The caterpillar which you send belongs to the striking species known in the South as the "Hickory Horned Devil." The moth into which it transforms, known scientifically as *Citheronia regalis*, is a large insect, having a wing expanse of about 5 inches and a beautiful olive and reddish coloration. This caterpillar feeds upon the leaves of the Hickory, Oak, Persimmon, and a few other trees, and the species is not a rare one. The larva, although so ferocious in appearance, is entirely harmless, and may be handled with perfect impunity. The negro's story is unworthy of credence, unless perhaps the dog was actually bitten by a poisonous snake which was not discovered.—[September 11, 1893.

NOTES FROM CORRESPONDENTS.

New Food Plant of Pseudococcus yuccæ.—The third week in June we received specimens of this interesting Coccid from Mr. D. W. Coquillett, who found it feeding upon *Ceanothus oliganthus*, at an elevation of from 2,000 to 5,000 feet. It occurred in large numbers, one medium-sized tree having been nearly killed by it. The other food plants of the species are *Yucca whipplei* and *Mimulus glutinosus*.

The Eggs of the Leopard Moth.—Mr. Herman Meeske, of Brooklyn, has been kind enough to send us a female of *Zeuzera pyrina*, taken in the act of ovipositing. He also sent us the entire batch of eggs, which we have had carefully counted, with the result that between 1,000 and 1,100 eggs were found.

Cigarette Beetle eating Silk.—A correspondent of the Division writes from Winter Park, Florida, to complain of the damage done by beetles and larvæ of *Lasioderma serricorne* which are feeding upon silk with which certain furniture is upholstered in her house. We have recommended either benzine or bisulphide of carbon treatment and place the fact on record simply on account of the habit.

A new Food Plant for Papilio turnus.—Dr. Ben. H. Brodnax, of Brodnax, La., sends us the larva of the common Tiger Swallowtail, which he found upon some camphor trees (*Camphora officinalis*) growing in his vicinity, which were sent out from this Department some years ago.

Vedalia at the Cape of Good Hope.—Hon. T. A. J. Louw, who carried over Vedalia to the Cape of Good Hope last year, writes us, under date of June 8, that although claims have been made that the native *Rodolia iceryæ* is equal to the Vedalia in keeping Icerya in check, later developments show the superior value of Vedalia. The latter insect has increased so numerously in the cages that they are being distributed to all parts of South Africa.

An Army Worm occurrence.—Dr. G. A. Hankins, of Toano, James City County, Virginia, wrote us under date of the 17th July that the Army Worm, *Leucania unipuncta*, was present in his millet by the thousands. The worm was noticed in small numbers in the same field last year. He also sent specimens of the Red-tailed Tachina fly, which is stated to have been so abundant that the buzzing sounded like a swarm of bees. We assured him that the worms will not be injurious next year. The most interesting point of this instance is that the injurious brood of these insects is certainly the second and perhaps the third generation. The usual date for the appearance of a destructive brood in southern Virginia is the latter part of May or the first week in June, and this brood consists of the immediate offspring of the hibernating individuals.

Another predaceous Lepidopteron.—Mr. J. G. O. Tepper, of the South Australian Museum, writes us, under date of May 30, that he has reared *Thalpochares dubia* from a larva found feeding upon the Black Scale in South Australia. The predatory species is not numerous enough, however, to produce any appreciable effect upon the scale insect.

Kerosene Emulsion against the Hop Louse.—Prof. F. L. Washburn, of the Oregon Experiment Station, writes us that he has tried kerosene emulsion on the hop vines much stronger than has been recommended in various bulletins with no bad effects to the vines. He therefore infers that the complaints of growers in this connection arises from their carelessness in compounding and using the emulsion. This is a significant statement, since in a recent bulletin Prof. Washburn concludes that the emulsion is unsafe for the average hop-grower to handle.

Periodicity in Insect Attacks.—A correspondent in answering our Cicada circular mentions the fact that in his opinion tent caterpillars have periods of 13 years, judging from the fact that at such intervals he has noticed that they are very abundant. This observation, however, is founded upon a coincidence and one which affects only a single locality. Fall web worms are annual or semi-annual in their development and the fact that we have seasons of immunity from their attacks is due to the unusual appearance of parasites or to unfavorable climatic conditions.

Army Worm in New Mexico.—Mr. T. D. A. Cockerell informs us, under date of August 9, that *Lecanium unipuncta* is present near Las Cruces in the larval state in millions. One field of alfalfa was defoliated and the caterpillars were destroying Corn and Capsicum and even climbing Apple trees.

A new Hopperdozer.—Rev. M. Wirtner, of Boulder, Colo., writes us that this summer a hopperdozer 15 feet long, 2 feet deep, and 4 to 5 feet wide was constructed by a prominent ranchman for the purpose of fighting the local grasshoppers which have been so destructive. The box was divided into 16 compartments and each compartment filled with milk-white lime water. Excellent success in the use of this contrivance is reported.

Fondness of small black Ants for Kerosene Oil.—Some recent correspondence with Mr. H. L. Hutson, of Texas, and Dr. W. S. Dudley, of Georgia, shows that flat boards covered with kerosene and placed near the nests of *Dorymyrmex pyramicus* in a Georgia town proved very attractive to the ants. They clustered upon it and brought grains of sand with which to cover it. Wherever such kerosened boards were placed the ants found them and covered them with fragments of sand and wood. This is a habit new to us and would seem to indicate that the ants appreciate the danger to themselves of leaving the kerosene uncovered.

GENERAL NOTES.

PARTHENOGENESIS AMONG SPIDERS.

Under the above title* Mr. Damin presented a paper before the zoologisch-botanischen Gesellschaft of Vienna at its meeting of March 1, 1893. After referring to the frequency with which parthenogenesis occurs in the various orders of insects, Mr. Damin stated that up to the present time it had not been reported as occurring among spiders. He then recorded what he believed to be a case of the parthenogenesis of Araneina. In the spring of 1891 he inclosed separately two living specimens of *Filistata testacea* Latr., for the purpose of observing them. One of these molted twice during the summer of 1891 and once the following spring, "a proof," Mr. Damin says, "that when inclosed it was unripe—that is, was, according to our present knowledge of the subject, incapable of reproduction." This female spun an egg-sac on the 8th of July, and eighteen days later Mr. Damin was surprised upon opening the egg-sac to find sixty-seven young spiders in it. Two days later they molted. At the time the paper was presented the young spiders were still alive and have safely molted once outside of their cocoon. Mr. Damin asks: "Does this not tend to prove that parthenogenesis obtains in the case of *Filistata testacea*, and perhaps also with other spiders?" And he adds: "The possibility of a mistake is here out of the question." Mr. Damin then refers to the fact that this Filistata is very common in Croatia, and is well represented in his collection, but says that he was struck by the fact that there was no male among them, and that he had never seen a male, either dead or alive. He then asks if this absence of the male does not indirectly indicate the parthenogenesis of Filistata, and adds that neither Thorell in his two works nor C. Koch mentions the male of *Filistata testacea.* The arachnologists, Dr. C. Chyzer of Ujhely, and Prof. W. Kulczynski, of Krakau, wrote that they had not found the male of Filistata. The latter had received one male specimen from Madeira. Mr. Damin remarks further that additional observations are necessary to show whether parthenogenesis is a chance occurrence with Filistata, as with *Bombyx mori* and some butterflies, or something which occurs normally, as with Psyche, Solenobia, etc. He mentions also, as worthy of note, that this female spider which had produced young parthenogenetically cast its skin two months later, although it has been considered well established heretofore that after the first deposition of eggs spiders do not molt.

The evidence thus adduced by Mr. Damin seems to us inconclusive, since spiders in confinement are well known to differ somewhat from their normal habits, and especially are known to shed one or more

---

* Ueber Parthenogenesis bei Spinnen. N. Damin, Verh. d. k. k. zool.-bot. Gesell. in Wien, Jahrg. 1893, XLIII Band; II Quartal.; pp. 204–6.

skins, although adult. The fact, then, that the specimens under observation by Mr. Damin shed skins does not prove that they were immature when captured. Having shown the possibility that they were mature, the further possibility that they had been impregnated by the male before capture and that the spermatophores had remained alive in the *receptaculum seminis*, as they have been known to do for months, must be admitted. The entire evidence thus breaks down and we must await further proof. It may be worthy of mention also that the male of Filistata is well known in this country.

THE BLATTARIÆ OF AUSTRALIA AND POLYNESIA.

In the Transactions of the Royal Society of South Australia for 1892, Mr. J. G. O. Tepper has published an important paper describing fully the Blattariæ (or Cockroaches) of Australia and Polynesia. He brings into his list 193 species, representing 33 genera and 10 families, of which one family, 9 genera, and 55 species are new. This is a very considerable proportion of the known species of the world. Eliminating the many synonyms which occur in Walker's catalogue of the species in the British Museum, Brunner van Wattenwyl has computed the number of endemic species to be 343 and those of wide distribution to be 35. Two only are wholly cosmopolitan, and these are *Periplaneta orientalis*, the common Black Beetle of England, and *P. americana*, the large, brown, long-winged species of this country. Mr. Tepper gives available synoptic tables of families, but unfortunately for the student publishes no tables of genera and species, and has also been unable to give illustrations. The publication is still a very valuable one, however.

AN INJURIOUS HAWAIIAN BEETLE.

Hon. I. Marsden, commissioner of agriculture and forestry of Hawaii, has sent us, among other interesting things, specimens of a Scarabæid beetle (*Adoretus umbrosus*) which he reports is rapidly becoming a most serious pest. They were first noticed about two years ago and were said to have been brought over from Japan. They are seen after dark in enormous numbers and riddle the leaves of many trees and plants. The genus is not represented in the United States, and it is unlikely that they were introduced from Japan to Hawaii, as they are not known in the former country.

THE SWEET POTATO WEEVIL IN JAMAICA.

In No. 47 of the "Notes of the Museum" of the Institute of Jamaica Prof. C. H. T. Townsend reports that on the island of Grand Cayman *Cylas formicarius* has been found attacking potatoes of all kinds, "but especially the large white variety." The insect has apparently been introduced from Cuba or Pedro (St. Elizabeth), where it

abounds. It seems that only tubers of a certain size are attacked, and early digging sometimes avoids the attack. Sandy soil and deep planting are said to be preventives to some extent.

THE "TOM RAFFLES" ANT OF JAMAICA.

No. 45 of the "Notes from the Museum" of the Institute of Jamaica contains an account by Prof. C. H. T. Townsend concerning the ant known popularly by the name of "Tom Raffles" in the British West Indies. It is *Formica omnivora*, and was brought to Jamaica from Cuba in 1762 by Mr. Thomas Raffles, who thought that it would devour the Jamaican ants and other noxious insects. It failed to do the intended work and became a pest itself. Prof. Townsend's note is one asking for information simply, as he is not aware of the present condition of the species on the Island of Jamaica.

AN INTERESTING OBSERVATION ON THE LARVA OF EPHESTIA KUEHNIELLA.

In the last number of INSECT LIFE we reviewed the elaborate investigation of M. J. Danysz, of Paris, on *Ephestia kuehniella* as a flour pest in France. The same author contributes to No. 7 of the *Bulletin des Séances de la Soc. Entomologique de France*, April 12, 1893, an interesting note upon the pigment spot (the embryonic testicle) of the larva of this insect. While searching for the natural enemies of Ephestia, M. Danysz's attention was drawn to a note published in 1887 by Mr. Archibald Geikie who reported the complete destruction of Ephestia in a flour warehouse in London by an Ichneumon (*Bracon brevicornis*), of which he figured the male and female. Mr. Geikie said in substance that he had noticed on the backs of the Ephestia larvæ a black spot, which he had not observed before, but paid no attention to it, thinking it a normal phenomenon in the development of the insect; but that some weeks later he was astonished to find on the sacks of flour which had been covered with the larvæ of Ephestia a great quantity of little black flies, and he then recognized the fact that the black spot was nothing else than the egg of *Bracon brevicornis*, the larvæ of which had devoured those of Ephestia.

M. Danysz then segregated a number of the Ephestia larvæ with the black spot upon their backs, in the hope of securing some of the Ichneumons, but his expectations were disappointed, for they all transformed successively to chrysalides and adults without presenting any abnormal features, while of the Ichneumons he did not secure a single specimen. His close observation of the black spot, however, furnished him with a very interesting observation.

The pigment spot in question is situated on the dorsal face of the fifth anal segment and lies under the cuticle, without attachment to it. By dissection he found it to consist of two reniform corpuscles placed in

the cellular tissue above the digestive tube and strongly colored with reddish-brown. Continuing his observations, M. Danysz was able to find the same organ, a little modified but sufficiently recognizable, in both the chrysalis and the adult; in the latter the two reniform bodies being united into a single ovoid body. In the adult also this ovoid body is connected by two long canals with the genital armature, and as, moreover, the larvæ with black spots always produced male adults, there is no doubt that Mr. Geikie's Ichneumon egg is simply a testicle in process of evolution. It is interesting to note that among insects which undergo complete metamorphosis, as is the case with Ephestia, there is generally histolysis of all the organs of the larva during the chrysalis stage; here, however, the testicle formed in the body of the larva continues to develop in the chrysalis while all the other organs undergo complete histolysis. It is perhaps the first example of a larva the different sexes of which are so distinctly marked by a character which is visible externally. M. Danysz proposes to complete his interesting observation by a more profound histologic examination.

THE CARNATION "TWITTER."

We have recently received an inquiry from Mrs. Celia Thaxter, of Isle of Shoals, concerning a new disease of her Carnation plants. An examination of specimens showed that the trouble was caused by an Anthomyiid larva working in the stems of the plants near the ground. Many plants were killed and we are now endeavoring to rear the adult insect. Mrs. Thaxter called our attention to a paragraph in Peter Henderson's Catalogue of Plants which evidently refers to this insect:

> The Carnation Twitter is an insect but little known and in this district only by its local name of "Carnation Twitters," given from its rapid and nervous motion. As seen by the naked eye, it is about the twentieth of an inch in length, and of a thickness not more than that of a needle point. It is of various shades of color, from green to black. It is never very numerous on plants, but most destructive, and evidently poisonous in its attacks on all varieties of the Carnation or Dianthus family. Its effects on plants somewhat resemble those of the Red Spider, except that when attacked by the Twitter the leaves have a cankered and twisted appearance, easily distinguishable from the browning effects of the spider, and it is far more destructive. We have often seen thousands of Carnation plants destroyed by it in a season. We regret to say that so far we have found nothing that will destroy this insect that does not at the same time injure the plant. We have tried tobacco in all forms, lime, soot, hellebore, Paris green, quassia, aloes, and all the nostrums usually baneful to insect life, without seeming in the slightest to disturb the Twitter. We have found, however, that its ravages are worse on light soils. On heavy stiff clay land we have never know it to do much injury.—[Henderson's Handbook, new edition, under insects, p. 204].

Are any of our readers familiar with this trouble, and can they send us additional specimens to assist in the full study of the life history?

A MEALY BUG ENEMY TO SUGAR CANE IN THE WEST INDIES.

We have recently received from Mr. Barber, director of agriculture of the Leeward Islands, two very interesting mealy bugs which are

found upon sugar cane on the island of St. Christopher. The one appears on the roots and the other in the axils of the leaves. Curiously enough, they appear to form two new species of a new genus near Dactylopius, which we hope to describe after further study on receipt of new material. The species on the roots, according to Mr. Barber, promises to cause a great deal of annoyance on estates not properly manured or cultivated. The young plants come up a sickly yellow or rusty color and require frequent replacing. They manage, however, most of them, to throw the pest off with the reproduction of fresh roots, so as not to suffer materially. Mr. Barber noted 37 acres severely attacked. The planters claim that lime and ashes are efficacious and also superphosphites.

ANOTHER EMASCULATING BOT.

Mr. F. Stephens, West Creek, California, sends us two "warbles" taken from the body of a parasite mouse (*Sitomys californicus*). Mr. Stephens trapped the mouse on the upper Temecula River in California. The warbles were found in the scrotum, with air holes in the back part of the same. On the rump was a small sore, which, on skinning, was found to contain another warble, dead and partly decomposed. Mr. Stephens thinks the mouse was able to reach this point with its head, and that it had killed the larva. The species is plainly Cuterebra, but differs from any which we have seen before, approaching, however, most closely to *C. emasculator* of Fitch, which occurs abundantly in the east in the axillary regions and near the genitalia of the Red Squirrel and Striped Gopher. Mr. Stephens has promised to try to rear any further specimens which he may find, and we hope that other observers in the same locality will watch for this interesting form.

THE EGYPTIAN ICERYA IN INDIA.

In our last number we announced the finding at Madras, India, of *Icerya ægyptiacum*, specimens of which we received through the kindness of Mr. Robert Newstead, of England. We wrote our correspondent, Mr. E. C. Cotes, of Calcutta, to ascertain whether the species was widespread in India, and he was fortunately able to find it at once upon Croton plants in the quadrangle of the Indian Museum. He also found it infested with secondary parasites identical with the form which we had received from Mr. Newstead, but was unable to find the primary parasite, which, however must exist and will undoubtedly be found in the near future. The scale insect does not seem to be particularly abundant in India, and its rapid multiplication in Egypt is probably due to the fact that the species is a comparatively recent introduction, and that it is an autochthon of India. Mr. Cotes finds that the Icerya is attended by an ant of the genus Cremastogaster, which he noticed busily prodding the scale insects with its antennæ.

A STRAWBERRY ENEMY IN JAMAICA.

No. 38 of the hektograph notes from the Museum of the Institute of Jamaica, begun by Mr. Cockerell and continued by Mr. Townsend, has just reached us. It concerns the damage done by a weevil larva which bores into the heart of the strawberry plant. Mr. Townsend considers this to be the larva of *Prœpodius amabilis* Waterhouse, a large weevil, from 21 to 26 millimeters long. Applications of fresh lime and kainit have been partly successful. It is to be hoped that Mr. Townsend will succeed in working out the life history of this weevil in detail, as the strawberry growers of our Southern States may become actively interested in this new strawberry pest.

SILK-SPINNING CAVE LARVÆ.

In *Science* for July 21, 1893, Mr. H. Garman describes under the above title an interesting larva which he has found in a small cave near Lexington, Ky., and which he determines to be Dipterous. The larva spins a glistening thread on the wall of the cave, clinging to its thread by means of pads provided with minute chitinous asperities. The ocellar areas are diminutive. The available food seems to be occasional tallow drippings and molds found growing on the walls of the cave. The insect is mainly remarkable from its silk-spinning habit. We are informed, in conversation, by Mr. H. G. Hubbard that he has seen the same larva and has proved it to belong to the family Tipulidæ.

MIGRATORY LOCUSTS IN CHILE.

We have just received from Mr. Edwyn C. Reed, recently appointed official entomologist in Chile, an interesting paper published the present summer on the migratory locusts which have, during the past two or three years, caused considerable damage in parts of that country. Several districts have suffered a loss of from 25,000 to 30,000 pesos. The species is identified as *Acridium maculipenne* and the usual remedies are given. Several other species are briefly mentioned, namely *Acridium cancellatum*, *Batracopus tibialis*, *Tropinotus ornaticollis* and *Acridium vitigerum*.

THE COLORADO POTATO BEETLE IN NOVA SCOTIA.

It is now about four years since the Colorado Potato-beetle made its first appearance in Nova Scotia, and since that time the provincial crop reports have made frequent mention of its occurrence and the amount of damage it has done. The crop report for July, 1893, gives in some detail an account of the ravages of the insect during the early part of the season, from which it appears that in general the insects are not as numerous as during last year, the localities reporting the greatest damage being Granville Center, in Annapolis County; the Polling dis-

trict, Cumberland County; Windsor, Hants County; Cornwallis, Kings County, and South Queens, Brookfield, Pleasant River, Kempt, and Liverpool, Queens County. The history of this insect in Nova Scotia possesses considerable interest for the economic entomologist, since this is probably its northernmost limit as a crop pest.

ITALIAN WORK ON THE COCCIDÆ.

We have elsewhere referred to the admirable work which has been done in Italy during the last few years in regard to the life history of certain species of Coccidæ, and our attention has recently been called again to this matter by the current number of the *Rivista di Patologia Vegetale*, vol. II, March–June, 1893. This number contains three important articles upon bark lice. The first, which is by A. Banti, carefully figures and describes all the stages of *Aspidiotus ceratoriæ* Colv., and the second is by A. Berlese, upon *Mytilaspis fulva*, a species which has been doing much damage of late years in the mulberry groves of certain portions of Italy. The author summarizes the life history of the insect, giving excellent anatomical figures and a table of the means which have been used against it. The third article, which is even more pretentious, is also by Signor Berlese. It is the beginning of an extensive and careful monograph of the Italian Coccidæ which live upon citrus trees. The present number contains a detailed consideration of two species only, viz, *Dactylopius citri* Risso and *D. longispinus* Targioni-Tozzetti, these names taking precedence of those given by Comstock in 1880 to the same species—namely, *D. destructor* and *D. longifilis.* The thoroughness of the treatment may be judged from the fact that the consideration of these two species occupies 44 large quarto pages with 35 text illustrations.

THE PENNSYLVANIA LOUSE STORY ABROAD.

We have elsewhere referred to the exaggerated reports of the plague of lice in Lancaster County, Pa., which appeared in press dispatches during July. The stories had but the slightest basis in fact, as we have shown. It only requires distance, however, to enlarge a newspaper story to gigantic proportions, and an editorial writer on the London *Evening Standard* has succeeded in producing a paragraph based upon New York dispatches which is calculated to produce a veritable panic. From the single occurrence of a few specimens of the harmless *Atropos pulsatoria* in an old hat, the ingenious writer evolves a plague which is comparable only to the Biblical Egyptian occurrences in the times of the Pharaohs. In three days four townships were overrun, a panic arose, the people fled to a distance, and the infested localities were quarantined. At the date of writing it was stated that further particulars were awaited with intense anxiety in England, on account of the probability that the insect would overrun the States and make its appearance abroad!

THE MOSQUITO IN ENGLAND.

We have not seen any notice in any of our scientific periodicals of the fact that the true New Jersey mosquito has made its appearance in England, although statements to that effect have appeared in the newspapers. We are able to confirm this rumor from personal experience. A large and voracious species of Culex, indistinguishable casually from the species common about New York harbor, is to be found in London and is not infrequent in the large hotels. They were particularly bad in 1886 at the Grosvenor hotel, Victoria Station, and proved even more annoying to the Londoner than to the many American guests of the hotel. These insects are undoubtedly being carried over occasionally in the large ocean steamers, and the gradual reduction in the length of time of the voyage will undoubtedly result in an increase of such instances. A recent number of the London *Spectator* mentions the fact that in a large colliery in the north of England the men at work in a distant part of the mine complained that the galleries were full of mosquitoes. As ordinarily it takes something worse than a mosquito to frighten a collier, the manager went down to explore, and found large yellow-banded wasps in great abundance.

BRITISH PHYTOPHAGOUS HYMENOPTERA.

We have recently received the fourth and concluding volume of Mr. Peter Cameron's very valuable Monograph of the Tenthredinidæ, Siricidæ (Uroceridæ) and Cynipidæ of Great Britain. This last volume is uniform in style with the preceding ones, and, while dealing chiefly with the Cynipidæ, includes a very considerable appendix to the first two volumes, which were devoted to the Tenthredinidæ, or Sawflies. The preliminary chapter on the gallflies (Cynipidæ), giving the general biology of these insects, includes a discussion of some very interesting topics, such as parthenogenesis, alternation of generations, parasites, inquilines, etc. Of the greatest interest, perhaps, is the conclusion reached in regard to the origin of the wonderful galls which these insects produce in such remarkable variety and complexity. The author rejects the theory which we have hitherto urged, and which is generally accepted, namely, that the poison peculiar to each species of Cynipidæ, which is injected by the insect into the tissues of the plant at oviposition, is responsible for the distinctive gall resulting from the sting of the species, and adopts the theory of mechanical irritation induced by the birth and growth of the larva as the prime factor in their genesis. Without stopping to discuss this matter now, it is sufficient to state that we are by no means convinced of the soundness of the author's views, and still think a more satisfactory explanation is the one first stated. A valuable summary of food plants is also given, with synoptic tables of galls and genera, followed by a very full description of the species, giving life-history, habits, and synonymy. The appendix to

vols. I and II relates solely to the sawflies, and is introduced to include the many new genera which have recently been added in this group, together with the limitations of genera due to the very careful and extensive studies of F. W. Konow. Mr. Cameron has translated the descriptions of most of the new genera erected by Konow, and also portions of the latter's synoptic tables. He gives also elaborate notes on the resulting synonymy and generic placing of species, and considerable additions to the list of food plants published in the first volume of the work. The volume ends with a very extensive and valuable bibliography of the writings on Phytophagous Hymenoptera and a complete index to the volume. Some nineteen excellent plates are included, which give very fair representations of most of the British galls and gall-makers, while other plates show the structure of the galls in magnified section. Mr. Cameron is to be congratulated on the publication of this volume, which closes for him the labor of a good many years and gives to the world a most valuable and important monograph on perhaps the most interesting of the Hymenoptera. The work is a publication of the Ray Society.—C. L. M.

THE BUMBLEBEE IN NEW ZEALAND.

A recent writer in *The New Zealand Farmer* makes a somewhat extended argument to show that the accounts of the enormous increase of this insect in that colony are exaggerated. He does not deny the fact that a great deal of good has been accomplished by the introduction of the species in the way of fertilizing clover, but contends that it only takes a few bumblebees to make a considerable rumpus.

LEEWARD ISLAND COCCIDÆ.

The following is a list of the Coccidæ which Mr. C. L. Barber, superintendent of agriculture, has personally collected upon the Leeward Islands:

Aspidiotus sp. Areca rubra and Sabal. Antigua.
Aspidiotus articulatus. Vitis vinifera. Nevis.
Aspidiotus aurantii Mask. Limes. Montserrat.
Aspidiotus budleiæ var. fallax Ckll. MS. (Morgan makes it = nerii). Mango, Terminalia, Cinnamomum. Antigua.
Aspidiotus personatus Comst. Areca rubra and Sabal. Antigua.
Aspidiotus punicæ Ckll. MS. Cocoanut husks. Dominica.
Ceroplastes cassiæ Chavannes = Ckll. MS. C. burseræ. Bursera gommifera. Antigua.
Ceroplastes cirripediformis Comstock. Eranthemum. Antigua.
Ceroplastes denudatus Ckll. MS. Sour sop. Antigua.
Ceroplastes plumbaginis Ckll. MS. Plumbago alternanthera. Antigua.
Chionaspis minor Maskell? Capsicum. Antigua.
Ch. (minor var.?) angustior nov. Ckll. MS. Pigeon peas. Montserrat.
Chionaspis timidus Ckll. MS. Hibiscus (Morgan makes it = Ch. minor). Antigua.
Diaspis ? sp. (Single white ♂ scale). Tangerine. Antigua.

Diaspis lanatus Ckll. (Inst. Jam., 1892.) Chionaspis major Ckll. MS. in litt. olim. Heliotrope. Antigua.

Ichnaspis piliformis Dougl. Sabal, etc. Antigua.

Lecanium assimile Newst. var. amaryllidis Ckll. MS. = L. amaryllidis Ckll. in litt. olim. amaryllis. Antigua.

Lecanium begoniæ (Dougl.) = L. praternum Ckll. in litt. olim. terminalis. Antigua.

Lecanium depressum Targ.-Tozz. Hibiscus. Antigua.

Lecanium hemisphericum Targ.-Tozz. General on all garden plants. Cycas. Antigua, Montserrat.

Lecanium longulus Douglas, 1887. Pigeon peas. Antigua.

Lecanium oleæ Bern. Terminalis. Antigua.

Mytilaspis citricola (Packard) Comstock. Tangerine. Antigua.

Planchonia bambusæ—Ckll. MS. Bamboos. Montserrat and Dominica.

Planchonia pustulans Ckll. MS. ♀ Asterodiaspis pustulans Ckll. Pigeon peas, Oleander, Custard Apple, perillea Mangoes. Montserrat, Antigua also in Anguilla.

Vinsonia stellifera. Cudisia, Euferria malaccensis. Montserrat also in Antigua.

ACTIVE GRASSHOPPER WORK.

In June of the present season the people of Kern County, Cal., were threatened with a plague of the California Devastating Locust. Two sections of worthless mesa land were found to be full of grasshoppers and eggs. Familiar with the best methods to use against these insects, hopperdozers were at once constructed, and at a cost of $1.25 per acre the land was completely rid of the insects.

THE PEACH MAGGOT FLY.

The recent damage done to peaches in South Africa by *Ceratitis citriperda* still occupies the attention of fruit growers in that colony. The Agricultural Journal of the department of agriculture at Cape Colony, in its issue of May 4, 1893, publishes a very extensive article by Mr. S. D. Bairstow as a second instalment of his series of papers upon insect pests. Mr. Bairstow gives the life history of the species, and a lengthy series of correspondence with fruit growers in the infested regions, also two full-page plates devoted to illustrations of the different stages and enlarged parts of the insect. The two remedies consist in the collection and destruction of the infested fruit and the "perpetual turning out of the pupæ from the upper half spit of your orchard for such light infantry as fowls and turkeys."

CRICKETS OF INDIANA.

In the proceedings of the Indiana Academy of Sciences for 1891, recently published, Mr. W. S. Blatchley presents a paper on the Gryllidæ of Indiana, which gives careful descriptions of the different species of this interesting family which inhabit the State. The paper is important for the reason that this group of insects has been almost entirely neglected by North American writers, and good descriptions of even the commoner forms have hitherto not been accessible. The descrip-

tions are accompanied by brief accounts of the habits, in which a number of original observations are given. Sixteen species, none of them new, comprise the list.

FATAL SPIDER BITES.

It has been generally believed in Jamaica, from quite early times, that serious results will arise from the bites of certain spiders. The following testimony from Dr. Cargill, of Half-Way Tree, confirms this belief, and has value as an independent statement of one who has had long experience in the island. The Queue-rouge is, of course, the *Latrodectus*, which is not uncommon in Jamaica. In the original MS. the omitted names are given, but I have received permission to send it for publication on condition that I omit them. The Colon spider is one of the old genus *Mygale*.—[T. D. A. Cockerell (June, 1893).

It was supposed that the whitlow which ended in blood poisoning originated in a spider's bite (in Mrs. ———'s case), but I was never satisfied that such was really the case. People are very apt to mix up *post* and *propter hoc* occurrences. There can be no doubt that venomous spiders, such as the Tarantula and Black spider (the little red-tailed *Queue-rouge* spider especially), have occasioned death in rare instances, either by the direct lethal effects of their poison or by blood poisoning secondarily. I have never had any death from spider bite in my own practice; but I have had many cases attended with severe pain and serious inflammation of the joints of the fingers. Capt. ———'s first wife nearly lost a finger from a black spider bite, and the late Richard Hill (naturalist), an old friend of mine, told me that he had a friend who died from a spider bite on his tongue. The spider was a *Queue-rouge*, and had got between the blades of some guinea grass which he had put in his mouth. There is a very large spider in Colon, which the people call Antelope, but which is no doubt a species of Tarantula. This spider has been known to kill dogs and horses, and the bottle which contains a good specimen in our museum has a label which states that the spider was supposed to have killed a girl. We have many interesting spiders in Jamaica, and if I can get a red-tailed black spider I will send it to you. It is far more venomous than a scorpion.—[Jasper Cargill (November, 1891).

POPULAR NAMES OF THE HORN FLY.

In our original article upon this insect, when it had spread only from New Jersey down into Virginia, we stated that it was called indifferently the "Texas Fly," "Buffalo Fly," and the "Buffalo Gnat." Since then we have heard of but three new popular names. In Delaware County, N. Y., it is called the "Canada Fly," in Alabama the "Hessian Fly," while in the Southwest it is known as the "Third Party Fly." Correspondents will oblige us by notifying us of any further popular designations.

ANOTHER "BLOOD-SUCKING" CONE-NOSE.

We have received, through the kindness of Mr. John B. Lembert, of Yosemite Valley, California, a species of Conorhinus new to the national collection, and which Mr. Lembert has always found in or about beds. The face, hands, and feet of the sleeper are often bitten, causing

swelling and a smarting sensation similar to that occasioned by Poison Ivy, and which usually soon heals, but in some instances is said to break out again and cause considerable soreness.

HOP LICE IN NEW YORK STATE.

During the early part of June hop lice were very prevalent in some portions of Otsego County, N. Y., and a repetition of the damage of 1886 was for some time anticipated, but, as has so frequently happened, the natural enemies of the insect appeared in almost equal abundance, and by the first of July the danger was past. This was a more or less local appearance, since in Oneida County no lice were noticed. In England, on the contrary, considerable damage has already been done by the lice and more is anticipated, as we notice from the *Kentish Observer* of recent date.

THE GYPSY MOTH IN CAMBRIDGE.

The home of the father of North American economic entomology has been invaded by the destructive Gypsy Moth, which, in spite of the assurances of the Commission, seems to have been spreading in the State of Massachusetts. Recent examinations show the insect to have become widely distributed through the town of Cambridge, and many hiding places hitherto overlooked have been found. Large colonies had sought the shelter of the sanctuary of the church and a number of nests were found under the steps of St. James Episcopal Church, on North avenue. The inspectors have been energetic and doubtless have prevented a serious plague, but they seem by no means to have succeed in eradicating the pest.

An interesting feature of the work of the past season has been a children's crusade, instituted at Hingham by the Agricultural and Horticultural Society. It is reported that seventy-five children were engaged in the work and they collected a total of 68,006 egg masses, representing at least fifteen millions of caterpillars. Prizes were awarded to the five who collected the greatest number.

A HOME-MADE SPRAYER.

We notice an interesting article in a recent issue of the *Kansas Farmer* describing at some length how a farmer can make an effective sprayer for himself which will be sufficiently powerful and capacious to spray a large orchard, while the total cost to make it, including the pump, will be only $13. The apparatus is very similar to the one which we have several times described in our reports, and which is figured upon Plate I of Bulletin 6 of this Division. It consists simply of a kerosene barrel mounted upon skids, with a strong force pump inserted above. Two or three points of importance were brought out in our description which have not been touched upon by the *Kansas Farmer* article, but the latter

is none the less valuable, and the attention of farmers and fruit growers should be drawn to the extreme ease with which a satisfactory spraying apparatus can be knocked together by any person with even a slight ability at handling tools. Such an apparatus is likely to be even more convenient and useful than the high-priced machines placed upon the market by manufacturers.

SILK CULTURE IN HELENA.

We notice that Governor Grey-Wilson, in a recent report to the Colonial Office, states that experiments are being carried on in the rearing and breeding of silkworms in the island of Saint Helena. The results so far obtained are said to have been very encouraging, and many thousands of mulberry trees have been set out. Rev. J. H. Daine, the resident Roman Catholic chaplain, is taking a very lively interest in the attempt, and has imported eggs from the Cape of Good Hope and from France.

THE HORN FLY IN ALABAMA.

The *Mobile Register* of June 10 devotes half a column to the subject of the sudden appearance of the Horn Fly in the northern portion of Mobile County, where stock raisers have invented a new popular name for it in "Hessian Fly," which the *Register* spells *Heschian*. The account gives the remedies which have been proposed by entomologists, and makes sundry misstatements, the most remarkable of which is, "from a single dropping will often issue more than 500 new flies within a few hours." The Horn Fly develops rapidly, it is true, but those who are familiar with our published accounts will recognize that this statement is, to say the least, somewhat exaggerated.

DAMAGE BY CHINCH BUGS.

At the present writing (July 7) the season of 1893 appears to be a favorable one for Chinch Bugs. Reports of great damage have come to us from parts of Kansas, Oklahoma, and Texas. In all these localities the injury has been aggravated by more or less severe drought. At two points diseased bugs from the State University at Lawrence, Kans., have been introduced, but, as we have been informed, without result, and we predict that the fungus and bacterial diseases will appear almost if not quite as soon in other localities. A change in the weather, with a wet spell, will induce the rapid appearance and propagation of both bacterial and fungus diseases.

ECONOMIC IMPORTANCE OF CHALCOELA AURIFERA.

Judge Lawrence C. Johnson sent us lately a wasp's nest which he had found, and called attention to the fact that its original builders had been ousted by a small Lepidopterous insect, which, upon examination,

proved to be *Chalcoela aurifera.* The observation is not a new one, but is recorded here because in this case it takes on economic importance. Judge Johnson writes that young wasps form the best perch bait, and their destruction by the Chalcoela thus interferes with an industry which, anglers will admit, is already attended with many drawbacks.

LEEWARD ISLANDS ENTOMOLOGY.

Elsewhere in this number we publish a list of the Coccidæ collected personally by Mr. C. A. Barber, superintendent of agriculture of the Leeward Islands, and we have now to acknowledge briefly the receipt of two interesting publications from his department. Mr. Barber has interested himself very greatly in the subject of the insect pests of the different islands of the Leeward group, and is doing excellent work. He publishes in the supplement of the Leeward Islands *Gazette*, which appears to be issued every Thursday. On June 22 a note appeared concerning the destruction of the coffee scale by fungus in Montserrat. The fungus has not been determined, but Mr. Barber is making efforts to introduce it into the island of Antigua. The supplement for June 29 contains a long report upon an outbreak of the shot borer of the sugar cane in the island of St. Christopher. Mr. Barber has recently investigated the outbreak very thoroughly, and his account, which covers fifteen pages of the *Gazette*, contains reprints of his circulars of information and his conclusions from his observations. The interesting fact is noted that the area of cultivation of Jamaica cane is the area of immunity from the shot borer. The principal recommendations of Mr. Blandford are indorsed.

AUSTRALIAN SUGAR-CANE INSECTS.

On pages 385–389 of vol. IV, INSECT LIFE, we published an article by Mr. Koebele on sugar-cane insects in New South Wales. The article was based upon observations made by Mr. Koebele in January, 1891, in the fields of the Colonial Sugar Company, from the Clarence to the Tweed River in New South Wales. The insects considered were (1) the larva of a Noctuid; (2) Scarabæid larvæ; and (3) Wire-worms, or Diabrotica larvæ. None of the insects were mentioned by name. In the *Agricultural Gazette of New South Wales*, part 5 of vol. IV, May, 1893, Mr. A. S. Olliff publishes a report on the insects affecting the sugar-cane crop on the Clarence River. In this report Mr. Olliff treats of the damage done by insects and gives technical descriptions of the species observed, accompanying the article with a full-page plate. The undetermined Noctuid mentioned by Mr. Koebele is described by Mr. Olliff as *Nonagria exitiosa* n. sp. Its parasites are described as *Apanteles nonagriæ* and *Euplectus howardi.* The different stages of *Cryptamorpha desjardinsii* Guerin and of *Brachypeplus binotatus* Murr. are described, the former being a predatory beetle and the latter a fungus-eating species. The larva supposed by Mr. Koebele to be Diabrotica is considered

by Mr. Olliff to belong to either Aulacophora or Monolepta, since the genus Diabrotica is not known to occur in Australia. The larvæ referred to by Mr. Koebele as undetermined Scarabæids were found by Mr. Olliff to belong to *Anoplognathus concolor*, *Lepidiota squamulata*, *Lepidoderma albohirtum*, and to an undetermined species of the genus Heteronyx. These larvæ, however, he did not find numerous or destructive.

THE BLACK PEACH APHIS IN NEW YORK.

In Bulletin 49 of the Cornell University Agricultural Experiment Station, Mr. M. V. Slingerland announces the appearance of the Black Peach Aphis (*Aphis persicæ-niger*) in Niagara County, N. Y. Mr. Slingerland follows this announcement with a compiled account of the habits of the species.

THE PURPLE SCALE IN CALIFORNIA.

The excitement in southern California of a year ago, over the importation of *Mytilaspis citricola* upon cuttings, will be remembered by some of the readers of this journal. The general consensus of opinion was that neither this scale nor the Long Scale (*M. gloverii*), was likely to obtain a foothold on the Pacific coast. According to the *Rural Californian* for September, however, the Purple Scale is now an established pest in one or two localities in Los Angeles County. We have not the exact facts, but see no reason to doubt the statement. It will be interesting to ascertain whether the conditions of dense shade and consequent moisture, so favorable to its development in Florida, hold in those localities in southern California in which it has appeared. So far as we know the genus Mytilaspis has no native representatives on the Pacific coast, but *M. pomorum* and one or two other species have shown themselves to be readily adapted to almost any climate.

INSECTS IN THE HUMAN EAR.

We are indebted to Mr. J. B. Nelson, managing editor of the *Post-Intelligencer*, Seattle, Wash., for the following clippings. Mr. Nelson states that both stories are well authenticated. The insect is probably *Lucilia macellaria*:

Toledo, September 1.—John McKune, a rancher and logger residing near Ladew post-office, is the subject of a queer affliction. While driving home from town one evening last week he felt a bug or fly of some kind strike his ear and crawl in. He endeavored to remove it, and supposed he had done so. A few days later his ear began to pain him, and he thought he could feel something crawling within. It became unbearably painful so he prevailed on a friend to pour the ear full of turpentine. The effect was magical. Twenty maggots came from the ear. A number of persons witnessed the exit of the maggots. Dr. Green was called and concluded that the fly had remained in the ear long enough to "blow," possibly, a score inside the ear, though the man thought the ear perfectly well. The victim is recovering, and the ear appears not to be affected.

Spangle, Wash.—William Weaver has a young man working for him who has been troubled for some time with a sore ear. Last Monday Mr. Weaver persuaded the

boy to let him examine his ear. He poured in some sweet oil, then took a straw and made a careful examination, after which he laid the boy on his side, and much to his astonishment about 150 maggots came out of his head and dropped onto the bench. The supposition is that a blowfly had gotten into the boy's ear some time while he was asleep and the maggots had hatched out and crawled into his head out of sight, thus causing him much pain. The boy had worked hard during the hay harvest, and was not willing to consult a doctor, although after the above discovery he was persuaded to do so.

A NEW PAPER ON SCALE INSECTS.

In the Transactions of the New Zealand Institute for 1892, Mr. W. M. Maskell, the well-known writer on Coccidæ, publishes a long article giving descriptions of a number of new species and notes upon a number of described forms. Perhaps the majority of the species were collected by Mr. Koebele on his recent journey to Australia. Scattered through the paper are a number of notes of considerable interest upon species already described. We note, for instance, that the Orange Chionaspis (*Chionaspis citri* Comst.), which is the commonest Orange scale in Louisiana, occurs also upon Citrus plants in the island of Tonga, in the South Pacific. Comstock's Camellia Scale (*Fiorinia camelliæ*) described from specimens found in Washington greenhouses, occurs also on Palms in Australia and on plants of the genus Leptospermum. *Parlatoria proteus* Curtis is found also upon the Apple in Queensland. Mr. Maskell considers that *Lecanium hesperidum* and *L. lauri* are identical. He is driven to this conclusion not only by the lack of good distinguishing characters, but by the fact that the English food plants of the two species are reversed in Australia and New Zealand, *L. lauri* attacking Citrus plants in the latter colonies, while *L. hesperidum* lives upon Laurel, Ivy, Holly, and other plants. *Lecanium tessellatum*, previously known only upon Palms in the hothouses of Europe, occurs upon Laurus in Australia, and *L. acuminatum*, previously known on hothouse orchids in Paris, is found upon Guava in the Sandwich Islands. A new species of Icerya is described under the name of *I. koebelei*, from specimens collected in Australia by Mr. Koebele upon Leptospermum. It is closely related to *I. purchasi*, but carries an erect dorsal pencil of wax and has invariably ten-jointed antennæ and a very small ovisac in the adult female. This is the seventh species of this genus to be described. The paper is accompanied by plates drawn by the author.

Mr. Maskell's papers on the insects of this subfamily are authoritative. He has worked upon them now for fifteen years, and has done almost the sole descriptive work upon the very rich Coccid fauna of Australasia. We can not, however, refrain from incidentally reiterating our criticism of the etymological form of his group names. He is the sole author who uses them, and they are distinctly in violation of the formulated rules of zoölogical nomenclature. There can be no sufficient reason for their perpetuation, and we earnestly hope that Mr. Maskell will see the necessity of falling into line with other zoölogists.

NOTES FROM THE MUSEUM OF THE INSTITUTE OF JAMAICA.

We have recently received from Prof. Townsend Museum Notes Nos. 42, 43, and 44, dealing with various entomological matters of interest on the Island of Jamaica. No. 42 adds a new scale insect to the local enemies of the vine in *Diaspis lanatus*, which has been found very abundantly upon the grape about Kingston, but which has a wide range of food habit. In No. 43 an enemy of the Casuarina tree is recorded, this plant having been supposed hitherto to be free from insects. The pest is a twig-girdler, *Oncideres pustulata*, a native species, as identified by the Entomologist from specimens received through Mr. Fawcett from Little London. No. 44 is a general note regarding the plague of ticks which the island is now suffering from. The species is doubtfully referred to *Hyalomma dissimile* Koch, and request is made for the sending of specimens. Mr. Townsend intimates that the excessive abundance of the tick is probably due to the interrelations of the Mongoose with the natural enemies of the tick, viz, native birds, reptiles, etc., and he suggests that the tick may be controlled by the importation of these natural enemies or the artificial breeding and encouragement of the native ones.

We may add, in supplement to Note 43, that in Australia Casuarina has a number of insect foes.

NOTE ON CEUTHOPHILUS EATING CURTAINS AND OTHER FABRICS.

In a note in INSECT LIFE (April, 1893, pp. 222–223) my statement made in the *Canad. Entom.* (January, 1893) that *Ceuthophilus pallidus* frequently eats holes in lace curtains in southern New Mexico, is questioned as abnormal and accidental. I can only reassert that it has been reported to me on several occasions as doing such damage, specimens of the insect seen in the act accompanying the information. I have also found it doing the very same injury in my own house in Las Cruces. The species is quite often found within doors in that region in the summer months.

As further confirmatory of my previous statement, I may quote the following information on an allied species, taken from a letter which was written me by Mr. Cockerell:

"I believe I told you that *Ceuthophilus pallidus*, which you reported eating curtains in New Mexico, had similar habits in Colorado. On looking up my notes I find it was not *C. pallidus*, but *C. maculatus* I was thinking of. *C. maculatus* was complained of as eating various clothes, etc., which had been hung out to dry after washing. It is a species of the higher altitudes (7,000 to 10,000 feet). I did find *C. pallidus* in Colorado, but only in the foothills of Pueblo County."—[C. H. Tyler Townsend.

U. S. DEPARTMENT OF AGRICULTURE.

DIVISION OF ENTOMOLOGY.

PERIODICAL BULLETIN. Issued December, 1893.

Vol. VI. No. 2.

INSECT LIFE.

DEVOTED TO THE ECONOMY AND LIFE-HABITS OF INSECTS, ESPECIALLY IN THEIR RELATIONS TO AGRICULTURE.

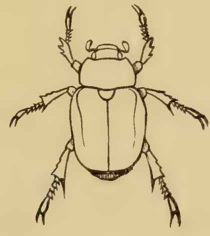
EDITED BY

C. V. RILEY, Entomologist,

AND

L. O. HOWARD, First Assistant,

WITH THE ASSISTANCE OF OTHER MEMBERS OF THE DIVISIONAL FORCE.



[PUBLISHED BY AUTHORITY OF THE SECRETARY OF AGRICULTURE.]

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1893.

CONTENTS.

SPECIAL NOTES.

Association of Economic Entomologists.—The bulk of this number is taken up with the Proceedings of the recent meeting of the Association of Economic Entomologists held at Madison, Wis., August 14, 15, and 16. While the attendance at this meeting was not as large as that at the very successful Washington meeting two years ago, sixteen active members were present and twenty-nine papers by eighteen authors were presented. The papers thus exceeded in number, and were, on the whole, more important and interesting than at any previous meeting. Five of them were from foreigners. The discussions were of great interest, and it is a matter of regret that they could not have been more fully reported. The Society has every reason to congratulate itself.

Handbook of Victorian Insects.—Some time ago we noticed the publication of Part I, "Handbook of the Destructive Insects of Victoria," by Mr. Charles French, the government entomologist at Melbourne. Part II of this work has just reached us. It is a handy volume of about 200 pages, illustrated by twenty-one full-page colored plates and by eleven black and white plates of machinery. The plates are, many of them, original and some are extremely good, particularly those of the larger Lepidoptera and Coleoptera. The smaller Hymenoptera and Hemiptera fail, however, in general appearance and in detail. The colored work is very good. Many of the species treated are peculiar to the Australian fauna, but their careful treatment is none the less important to us in the United States, since many, if not all, are liable to be imported into this country. Several insects common to both regions are considered, viz, the Black Peach Aphis (*Myzus cerasi*), the Plum Curculio (*Conotrachelus nenuphar*), the Cottony Cushion-scale (*Icerya purchasi*), the Oleander Scale (*Aspidiotus nerii*), the Red Scale of California (*Aspidiotus aurantii*), the Purple Scale (*Mytilaspis citricola*), the Grapevine Phylloxera (*Phylloxera vastatrix*), the Potato-tuber Moth (*Lita solanella*), the Diamond-back Cabbage-moth (*Plutella cruciferarum*), and the Cabbage Aphis (*Aphis brassicae*). Mr. French con-

fesses to some uncertainty as to whether the Plum Curculio really occurs in Australia, and the article is introduced upon this uncertainty. As in Part I the volume concludes with some consideration of fruit and grain-eating birds and lists of materials for the destruction of insects and of insecticide machinery. The volume marks a distinct advance upon its predecessor, particularly in the illustrations, which are reproduced in a very superior manner. Original drawings were made by Mr. C. C. Brittlebank under Mr. French's direction.

Manual of New Zealand Entomology.*—We have not before noticed Mr. G. H. Hudson's interesting book published under the above title last year. It is a handsome little volume of 120 pages and with many colored plates, nearly all of which are well executed. The work consists of some observations on the anatomy of insects in general, a popular definition of the seven Linnean orders, a chapter on methods of collecting, and a systematic consideration of certain types of families arranged according to classificatory position. By a rather curious arrangement this consideration begins with the Coleoptera and ends with the Hemiptera. The author seems to have made a large number of important personal observations on the life histories of different species. Owing to the restricted size of the volume only a small proportion of the families are thus considered, but as a general thing the accounts are full and presumably accurate and at the same time are written in a most interesting and rather popular style. Every insect treated is figured upon a colored plate, usually in the larval stage and sometimes in the pupal stage as well as in the adult. This method of taking a single type of each family treated is, perhaps, as good a one as could have been chosen for a work of this extent. The insects are many of them strange in appearance and some of the observations upon life histories are new to science. The only matters in the volume which are open to criticism are the ancient classification and certain mispelled family names. The book is well calculated to excite an interest in entomology and this is the avowed purpose for which it was written.

*An Elementary Manual of New Zealand Entomology for Introduction to the Study of our Native Insects. With twenty-one colored plates. By G. V. Hudson, F. E. S. Wellington, New Zealand. London. West, Newman & Co., 1892.

FIFTH ANNUAL MEETING OF THE ASSOCIATION OF ECONOMIC ENTOMOLOGISTS.

FIRST SESSION—AUGUST 14, 1893.

The Association met at 2 o'clock p. m. in Room 24, Science Hall, University of Wisconsin, Madison, Wis., August 14, 1893. The following officers and members were present:

President, S. A. Forbes, Champaign, Ill., second vice-president, J. B. Smith, New Brunswick, N. J.; secretary, H. Garman, Lexington, Ky.; J. M. Aldrich, Moscow, Idaho; G. F. Atkinson, Ithaca, N. Y.; G. C. Davis, Agricultural College, Mich.; C. P. Gillette, Fort Collins, Colo.; A. D. Hopkins, Morgantown, W. Va.; L. O. Howard, Washington, D. C.; M. E. Murtfeldt, Kirkwood, Mo.; H. Osborn, Ames, Iowa; C. V. Riley, Washington, D. C.; P. H. Rolfs, Lake City, Fla.; H. E. Summers, Champaign, Ill.; F. M. Webster, Wooster, Ohio; H. E. Weed, Agricultural College, Miss.

A number of visitors and members of other scientific associations were present during the session.

The call to order was followed by the delivery of the annual address of the president.

PRESIDENTIAL ADDRESS.

By S. A. Forbes, *Champaign, Ill.*

Gentlemen: It is my present pleasing duty to set in motion the machinery of this Association of Economic Entomologists for what is apparently to be the most important meeting we have ever held. No one acquainted with our field can look over the titles which our secretary has brought together for his preliminary program, or the names of those eminent in entomology and in its economic applications who have consented to prepare papers on these subjects, without recognizing the fact that this is an exceptional meeting; and I heartily wish that your choice might have fallen for this time upon either an older or a younger entomologist for the presentation of a general address; either upon one of those who have practically covered in the period of their careers the development of economic entomology in this country, and so might have brought to us the results of the fullest and most fruitful experience, or upon one of that interesting group of younger

men becoming each year more numerous and influential in our circle who, coming to their work with a finished scientific and technical training impossible to any here but a few years ago, might represent more fitly and fully than any other the future of our science, whose development they are hereafter to have in charge.

But fortunately we have this year both Moses and the prophets with us, and whatever shortcomings you may find in your temporary representative, who is neither one nor the other, but at most a little of both, you will be able easily to make good as this meeting goes on.

The literature of economic entomology in this country is so rapidly increasing that a full annual synopsis of it, readable within the limits of such an address of mine, is no longer possible, if, indeed, it was ever desirable. Taking into account the fact that American economic entomologists are working each by and for himself, altogether without general supervision, and commonly without mutual consultation or co-operative plan, and the consequent fact that our investigations are as a whole extremely heterogeneous, determined in each case largely by personal bias and local circumstances instead of by common objects and a general view, it has seemed to me that I might do you some service by scanning the field of our operations, and so classifying the results of our work as to give you a clear, if incomplete, idea of the drift and balance of our progress for the year.

I have consequently gone, with some care, over one hundred and fifteen economic articles, long and short, published by us since our last meeting, omitting all which contain no new matter and making my selection according to geographic distribution and practical importance. These articles I have grouped by subjects and by nature of outcome; and I beg to present here in very general terms the results of my examination, in the hope that I may help you not only to see—according to the slang phrase of the day—just "where we are at," but also to throw some indirect light upon the more important question, whither we ought to go next. It seems to me that if we are to move hereafter as we have done in the past, as a body of irregulars rather than an organized soldiery, an annual survey of our field, such as will help us to keep somewhat in line, or at least within supporting distance of each other, should save us much confusion of effort and some loss of time and opportunity.

In the first place, I have to observe that we seem from our publications fairly well satisfied as a body with our present methods of investigation and report; or, if not satisfied, then at any rate not in a condition now to improve upon them. I have not come anywhere upon any new method of research adopted or proposed in field or laboratory, nor seen in any of our publications any notable departure from the stereotyped form of printed article which has become habitual with us. Perhaps this is because—absorbed as we are in subjects—these matters of form and method receive less attention from us than they really

deserve. More likely it is because our economic papers do not fairly reflect our progress in this respect, and it may be that if we were to exchange ideas and experiences upon these topics at this meeting we should find ourselves able to improve each other's practice materially.

A similar statement may be made respecting new economic methods also; that is, new methods of prevention and remedy applicable to insect injury. We are generally busying ourselves with those we are already acquainted with, or, at most, with unimportant modifications of the old, and have this year proposed nothing radically new.

The insecticides and apparatus for their distribution are still prominent in our work, but I have nothing to report in the way of new insecticide apparatus or of new insecticides, unless Bruner's suggestion of corn meal for the Cabbage Worm may be mentioned under the latter head. Twenty articles giving new results of experiments with standard insecticide substances are on my list, the freshest and most notable of which are three on the destruction of insect eggs, by Cook, of Michigan, Smith, of New Jersey, and Slingerland, of Cornell. Others relate to cabbage worms, white grubs, the grass leaf-hoppers, the codling moth, the cutworms, the granary insects, and so on. The Bordeaux mixture has been further tried for entomological purposes, as reported by Garman of Kentucky, and a single combination experiment with insecticides and fungicides is described in the Cornell Bulletin. Slingerland's careful trap-lantern experiments (*Canadian Entomologist* for March) may also be mentioned here.

I find six references to the importation of insect parasites sufficiently important to deserve our notice, most of them, as heretofore, contributed by the United States Division of Entomology; one, however, by the West Virginia Station, whose Entomologist, Hopkins, visited Europe with a view to the special importation of the parasitic enemies of insects infesting forest trees.

The fungous diseases of insects seem to have received but little attention during the year, if one may judge from the slight and infrequent contributions to this subject. Almost the only item of special interest I have seen is an account of an unsuccessful experiment to destroy the American white grub by means of Giard's *Isaria densa*, a fungous parasite of the *vers blanc* of France, sufficiently prevalent there to have been cultivated artificially on a large scale and offered for sale to farmers. I may say here that our own experiments with this fungus, made last year, were moderately successful in the laboratory, where gelatine cultures were made without difficulty, and various species of melolonthid larvæ were infected successfully by dusting with ripened spores; but diseased white grubs placed in the earth with healthy ones did not convey the infection.

General agricultural methods have been quite fully discussed by Smith for cranberry insects in his bulletin for December, 1892, but I think by no one else; and some curious observations on the effect of

various kinds of fencing upon the distribution and abundance of certain economic species were reported by Webster in "*Science*" for December, 1892.

Coming now to the more strictly entomological part of the work of the year, we notice the discovery of three or four injurious species new to science,—as yet of little economic interest, however,—and a considerable number of species previously known but reported for the first time as injurious; one (a Crambid) to Corn, three to Cabbage, one an osage orange species, one infesting Wheat, another the Beet, still others the English walnut and other trees, two affecting the Peach, and one from Oregon attacking that and several other fruits. That katydids injure cranberries was, I think, previously known, but the amount and method of their injury has been methodically studied by Smith.

Among beneficial species, the insect parasites of scale insects have been most fruitfully investigated and two new forms described, and other new parasitic species have been bred from the strawberry weevil, the western locust, and so forth. Specially noteworthy are papers by Webster and Ashmead on parasitic Hymenoptera of Ohio, several new forms of which are economic.

In the department of life histories and habits,—the basis, as all will admit, of our economic work,—a suitable activity has been manifest. Besides matter of this description contained in monographic and complete accounts of various species presently to be mentioned, I have noticed no less than twenty articles making valuable contributions to life histories of economic species, prominent among which are articles on the White Grubs (Perkins), the Strawberry Weevils (Beckwith and Chittenden), three species of the Grass Leaf-hoppers (Osborn), the Elm-leaf Beetle (both Riley and Smith), the Bud Moth (Slingerland), and a Crambid christened by Miss Murtfeldt the Blue-grass Worm. Slingerland's experiments on the possible number of annual generations in a plant louse species are deserving of special mention here.

In this connection may be noticed a few items of various importance on the subject of the gradual extension of introduced insects—the Horn Fly being most frequently mentioned.

The single species, or larger groups, which have been deemed worthy of summary, and usually of exhaustive, treatment from the economic point of view, in papers aiming to bring together and present in résumé the essentials of their economic entomology, and containing new matter also, are the Bud Moth, the Cattle Tick, the Pear Leaf-mite, the Strawberry Weevil, the Black Peach Aphis, certain of the Sawflies, and the Scolytidæ of West Virginia.

The special plant groups whose insect enemies have been summarily and comprehensively discussed in a special paper for each group are the shade and ornamental trees of Nebraska, the small grains of Ohio, and the Blackberry and Raspberry in the same State. Here may be

mentioned also Webster's special notes on insects infesting the roots of Wheat, and Smith's work with Orthoptera in the cranberry field.

Further, the food of the Robin has been overhauled again in Ohio and that of gophers in South Dakota, both subjects entomological in their main interests; the relations of the codling-moth injury to apple rot have been studied in Kentucky, apiary experiments have been continued in Michigan, and a multitude of minor matters have claimed attention here and there.

In the critical remarks which I now propose to make, not so much on the nature as on the scope of our recent work, I trust that I shall not be misunderstood. It would be easy and pleasant to spend the time remaining to me in commendation and congratulation, but, I venture to think, less profitable in the end than to take these for granted and to look deliberately for deficiencies and for means of betterment. Undoubtedly, as it seems to me, so young an association, made up so largely of young men, should thoroughly criticise itself, its plans, its operations, and its tendencies, from time to time, with a view to giving its methods and its traditions an early set in exactly the right mold. And so, with the understanding that the comments I have here to offer are to be taken merely as my individual suggestions for your consideration, I venture to call your attention to some defects, as they appear to me, in our methods of report and publication; to certain failures of practical result and their remedy, and to a noticeable narrowness of view and consequent lack or inadequacy in our treatment of general questions, due to the want of comprehensive organization and systematic coöperation among us.

It is not the wealth one gathers, but that which he puts to use, which makes him rich. It is not the knowledge we acquire, but what we succeed in making application of, which makes us wise. It is not the facts of entomology we discover, but those which we persuade the farmer, the gardener, or the fruit-grower to use diligently for the protection or the preservation of his crops, which make our entomology economic. To discover without publishing effectually is to waste our time as servants of the public. To publish valuable results without making sure of their appreciation and appropriation by our constituents is to fail of real usefulness and the reward of usefulness. To bring a result to bear on the practice of one man only, when a thousand are suffering for the want of it, is to fail in ninety-nine and nine-tenths per cent of our proper undertaking. We must first do exact, exhaustive, conclusive, practical, economic work, and then we must find means to get that work utilized or it is an economic dead loss.

Our methods of report and publication, of dissemination and enforcement, are, in my judgment, lagging far behind our methods of research, and are receiving far too little attention; so little, indeed, that I do not remember that this topic has ever been effectually discussed at any one of our meetings. And yet, since it is the object of these methods

to give real effect to all our work, it seems to me that this topic is equal in practical importance, not to any other merely, but to all others taken together.

I need only appeal to the experience of any of our older entomologists for abundant evidence that the methods of statement, publication, and enforcement now generally made use of fall far short of their final end. Take the literature of the Hessian Fly and of the Chinch Bug as examples. Has the general average agricultural practice of regions overwhelmingly infested by these insects been really modified materially by all our work and writing, or does it go on substantially as it did fifty years ago? We have made a deep and decided impression, here and there, beyond a doubt; frequently, however, by merely seconding the efforts and sifting and substantiating the evidence of the farmer, as in modern methods for the Codling Moth and the Curculio; but the farmer has not responded with anything like the same readiness and perseverance to the suggestions of the investigating entomologist; and means of reaching, instructing, and persuading him should be carefully studied and discussed by us with a view to their radical improvement.

After this preface I hope that you may receive with patience a few suggestions on this subject, drawn from my own ten years' experience as an official entomologist.

In the first place, I am inclined to think that we are very likely to forget, when we prepare our reports, that we are writing largely for men to whom entomology is a perplexing, obscure, and displeasing subject, of which they know little or nothing, and especially nothing good; but that on the other hand, they are frequently experts in crop inspection, far quicker, as a rule, to observe injuries to their crops than we are, and more likely to discriminate them nicely. If we had always borne this fact in mind, I think that our economic articles would usually have taken quite a different form. The crop injury and its characteristic appearances would have led in our discussions, and remedial and preventive measures would have followed thereupon as immediately as practicable, the insect itself being brought in, if at all, in a strictly subordinate way, as an aid to the recognition and classification of the injury, and as a guide in some instances to the selection of an economic method. Now, all but invariably, we put the insect and its characters, its habits, and its life history in the foreground, and make everything else depend upon a knowledge and recognition of these. In short, in dealing with insect injuries to agriculture we have commonly insisted that the farmer must become an entomologist, at least so far as agricultural insects are concerned, whereas, in fact, the practical entomologist should have first become a farmer, at least so far as is necessary to a detailed and critical knowledge of insect injuries to crops and to the application of agricultural methods of procedure for their control. How far we have come short of this

requirement no one can fully know who has not attempted to cull from the literature of economic entomology good and complete descriptions of crop injuries due to insects.

It is especially in synoptical and monographic articles, on all the insects of a single crop that this defect of treatment is most manifest. The insect enemies of the Apple in a single State may number more than two hundred, as in Illinois, while the list of distinguishable injuries to this fruit, classified with reference to differences of treatment, preventive and remedial, is less than a tenth as many; and every orchardist will be glad to know these critically and to act upon this knowledge, while he will almost certainly balk at the requirement that he should become thoroughly and practically acquainted with so many insect species as a condition of success in apple culture. It will be a great step forward in our attempt to popularize the results of economic work and to make them immediately and practically useful, if we can convince those for whose special benefit it is done that one does not need to become an expert entomologist to obtain from economic entomology the greater part of the benefit which it has to offer to the practical man—a step which I believe can only be taken by habitually putting to the front in our articles, and especially in our synoptical discussions, insect injuries, their full and precise description, their classification and treatment, as the principal features, bringing in the insects themselves—their description, habits, life histories, and the like—as secondary and subordinate matter, to be avoided, indeed, entirely, unless there are cogent reasons for its use. The acceptance of this idea would lead to the bringing together from time to time of all the literature of economic entomology for each crop or class of crops; to a critical overhauling of it from this strictly practical standpoint; to a good deal of field observation and laboratory experimentation for the preparation of fuller and more accurate descriptions and illustrations of insect injuries than are now current; and especially to the breaking up and melting up of a great mass of entomological knowledge and the recasting of it in the agricultural mold.

I think we should further distinguish in our publications and reports between what we may call temporary and permanent presentation. If we would reach the actual farmer with our publications it is useless to depend for any permanent influence on miscellaneous collections of articles such as make up the bulk of our bulletins and reports. They may be read occasionally as received—at least such parts of them as chance to treat of matters specially and locally important at the time—but they will soon accumulate from various sources as a heterogeneous mass, with neither beginning nor end nor index, from which our farmer friends are little likely even to brush the dust. We should hence make regular provision, in my judgment, for the preparation of special economic summaries or monographs of all insect injuries to each of the various crops, agricultural and horticultural, prominent in this country,

and should see that these are printed and distributed in numbers which might be called enormous as compared with those now commonly issued. As the preparation of such monographs is a great and irksome labor, wasteful of the time of the investigator, and yet requiring a conscientious thoroughness which only the investigator is likely to devote to it, and as the work once well done by one need not be done again, but may be made available for all, it seems to me that this is a matter which our association should take up through some general standing committee on coöperation, or by means of some less formal agency of subdivision and assignment.

I hardly need repeat that in these synoptical articles the thoroughly practical method of treatment and presentation is called for most of all. They should be articles on crops and not on insects, and should be written from the standpoint of a farmer turned entomologist, rather than that of an entomologist vainly trying to see through a farmer's spectacles.

The *viva voce* presentation of entomological matter at the farmers' institute, with its opportunities for explanation and illustration, for question and answer, and for the off-hand discussion of subjects of living interest to the time and place, is a new agency for the distribution of economic information which none of us will neglect. It has, however, the disadvantage that its utility depends on correctness of apprehension and accuracy of memory on the part of those little accustomed to take and hold instruction from the living teacher. I will, myself, never give another farmers' institute address, if I can help it, which is not followed up with a printed résumé, distributed to the audience.

But, now, supposing full and accurate information widely disseminated and in the actual possession of those for whom it is especially designed, we have next the most difficult task of all: to make sure that it will be practically applied. What shall we do and what advise to secure a common action in accordance with known and admitted facts? Shall we leave this to the individual and to the coercion of neighborhood opinion, or, these failing, shall we look to the law and to agencies established under the law? In short, are we practically individualists or socialists in our leanings? The official entomologist, I need hardly say, need not shrink from the word socialism, for as a Government official he is himself a socialistic product; as much so as the experiment station or the public school. Without attempting here to debate so large a question, I venture to express my own opinion that we should look to the law and to some regularly established system of inspection and penalty enforced by law to supplement the spontaneous agencies of society where these fail to protect the industrious and intelligent against the destructive consequences of neglect on the part of the idle and the ignorant. There are regions—some parts of my own State worst infested by the Chinch Bug, for example—where there seems really to be no choice between legal compulsion on the one

hand and the slow and enormously expensive operation of the law of natural selection on the other. Either the slow processes of social and economic revolution must be allowed to take their destructive course, carrying down too often the bright and willing farmer with the hopelessly sluggish mossbacks all around him, who breed insects by the bushel to devour his crops with their own, or we must have a State or county board, acting in conference with the official entomologist, empowered to recommend a protective procedure in cases which are clear beyond all reasonable controversy and to assign penalties for a failure to conform. I would, myself, advise both State and county boards—perhaps those agricultural boards already existing—on the ground that it is useless to attempt to enforce measures, however plainly necessary, against the common sentiment of the locality.

Next and finally, I beg to call attention to some facts growing out of the dispersal of most of us, one or two in a place, and to the territorial limitations set upon the work of those of our membership who are in State official positions. The boundaries of the States we supervise are usually artificial and not natural, especially not entomological or agricultural, from which follows the fact that several of us are interested, in very many cases, in the same problems, presenting themselves under identical or very similar conditions, and the further fact that some of these problems require for their solution a broader territorial range than we are expected to take. We are also commonly so pressed upon by a multitude of minor practical matters of special but temporary interest, that no one of us can command the time for continuous study of large general questions, either theoretical or more directly practical, which affect all of us more or less, but which remain from year to year substantially untouched.

There is in the Mississippi Valley what is known as the "chinch-bug belt," running from southern Illinois through Missouri and over the larger part of Kansas, a district where two or three dry years may always be expected to bring that arch pest of agriculture to the front. We are all at work upon it, but each for himself, without concert of plan or regular interchange of ideas and results. On the other hand, none of us are studying the general subject of the reasons, geological, agricultural, or climatic, for the existence of this well-marked belt. If I am asked why southern Illinois is thus infested while southern Indiana is relatively free, I can merely guess at a more or less probable reply.

Further, we occasionally find, when far advanced on some piece of unmitigated drudgery, some laborious and tedious compilation of the literature of a single crop, for example, that one or two others in neighboring States have long been busy with the same subject, and that much work has thus been duplicated to no good end. I lost the larger part of a year's work of one assistant in this way not long since.

Now the remedy for these and other defects which I have not time to specify is not general direction, or even supervision—we are too

intensely American to submit gracefully to that—but organization rather, and that of some loose and perfectly flexible form, which will leave each entirely free to meet the special requirements of his individual work, but will at the same time help to concentrate and coördinate the surplus effort which all, or several, may be willing to contribute to the accomplishment of common ends. For this purpose I would suggest a system of what we may call volunteer committees. Let an association committee on coöperation propose a list of subjects for which in its judgment coöperative effort is desirable. Let this list be discussed and amended, if need be, by the association at its fullest meeting, and increased or changed from time to time thereafter, and then let volunteers offer for the the various subjects, some to work singly on topics of general interest (from which others should then withhold their hands), and some to combine for purposes requiring combination. Each volunteer committee would naturally report progress to the general committee previous to our annual meetings, and the general committee would make a general report in turn to the association itself, with such recommendations as the experience of the year might indicate. As subjects were satisfactorily completed, the results would be presented to the association for publication, or published independently in the bulletins or reports of those engaged in the work, as might be desired.

I venture to think that in some such way we may obtain all the essential benefits of organization without any surrender of individual initiative, and without hampering ourselves in any respect.

But whatever may be your decision on these general matters, and whatever form the general policies of this association may finally assume, our strength is now and will always be in the ability, skill, activity, and public spirit of our individual membership, and in these particulars I need not say that we have every reason for satisfaction with the past and encouragement for the future. I congratulate you most heartily, ladies and gentlemen, on the solid and useful character of the year's work just past, and on the brilliant prospects of this, the fifth regular meeting of our association.

The address was discussed by Messrs. Osborn, Smith, and Webster. Mr. Osborn thought that laws requiring farmers to destroy insect pests appearing on their farms could be made effective, and gave the operation of the Canada thistle law in Iowa as an example. He thought that such laws should apply in all cases only to such pests for which good remedies could be recommended. The Fall Web-worm could, he thought, be easily controlled in his State if everyone was required to destroy it whenever it appeared on his place.

Mr. Smith spoke of the difficulty of inducing many farmers to take any precautions in checking the injuries of insects, and thought that laws requiring them to give attention to such matters could not be enforced. The weed law of New Jersey was mentioned as an example of the ineffective working of such laws. He was of the opinion also that

the number of laws required if one were made for each pest would be a difficulty not easily surmounted, since it was not easy to get legislators to pass such laws.

Discussing the suggestions as to combined effort on the part of official entomologists, Mr. Webster suggested that it would not in some cases be practicable for station entomologists to do any work but that required in their own States because of opposition from the directors and other authorities.

Mr. Forbes thought a community which would not enforce laws relating to farm pests must be left to suffer, but he had known instances where public opinion on these matters was such as to compel farmers to give them attention.

Reports of officers were then called for. The secretary reported that for the printing of circulars, invitations, and programs the sum of $10.55 had been expended during the year, for which an assessment of members attending the meeting would be necessary.

Mr. Webster moved that a committee of three be appointed by the chair to consider the matter of raising funds for the regular expenses of the association. Messrs. Webster, Smith, and Hopkins were appointed.

Messrs. Edward H. Thompson, of Tasmania, and R. Allan Wight, of Auckland, were proposed as foreign members of the association by the secretary.

Mr. Smith moved and Mr. Osborn seconded a motion calling for the appointment of a committee of three to consider the recommendations contained in the address of the president. Messrs. Osborn, Smith, and Garman were appointed.

A paper by Mr. Osborn was next read.

METHODS OF TREATING INSECTS AFFECTING GRASSES AND FORAGE PLANTS.

By HERBERT OSBORN, *Ames, Iowa.*

In the treatment of this subject, it is desirable to consider all the insects affecting the crops mentioned, especially with reference to the duration of life and the time spent in the several phases of existence. It will be manifestly impossible to treat in detail the individual species attacking these crops, even were it desirable on such occasion, and in order to condense the matter sufficiently and still exhibit the essential facts, I have prepared a table, giving the names of the important species in each order and showing the stage in which they are to be found in any particular season; also, part of plant attacked and duration of life cycle or annual generation.

It may be proper to state that to properly limit the paper, I have considered the term "forage plants" to cover the clovers and only such crops as are commonly used for pasture and not including such crops as corn, oats, rape, and some others that may occasionally be used in this manner. Reviewing now briefly the more important groups affecting these crops, we have in the Hymenoptera no species which need claim our particular attention, though the Wheat Joint-worm, *Isosoma hordei*, sometimes affects grasses. In the Lepidoptera we have among the species of Colias, Lycæna, and various species of Hesperiidæ numerous examples which affect clover or grass, but few of them are known to be particularly destructive. They have not received much attention from the economic standpoint. Their habits render them free from attack by any available method and in general they must be left to the attention of their natural enemies. In the family Noctuidæ we have an assemblage of species which are notably pasture-infesting forms and many of them are extremely destructive. Such species as *Agrotis bicarnea, messoria and saucia; Hadenaa devastatrix, and lignicolor; Nephelodes violans, Leucania unipuncta and albilinea* being representative forms. In nearly all the species, the damage is mainly caused during the night time and the larvæ are sheltered or concealed during the day time, either at or under the surface of the ground. From the fact that they cut off leaves and stems the damage they do is far greater than the loss of the mere portions which they eat. In the majority of these species the eggs are deposited and the larvae become partially grown during late summer and autumn, and consequently early plowing of sod land which is to be used the following season for some other crop must be recommended.

The Clover Hay-worms, *Asopia farinalis* and *costalis* affect particularly stored hay, including clover, but attention to clearing out affected haymows and stack bottoms during spring, and burning the webbed portions, including worms and pupæ, should prove effectual. In the family Pyralidæ, we have a group of insects, Crambus and allied forms, which are essentially pasture and meadow species. Species of Crambus, particularly, form silk-lined burrows just beneath the sod and come to the surface and cut off grass above the crown. The species, *Crambus vulgivagellus*[1,2] and *exsiccatus*[3] have been studied in this country, and it seems that when at work in the grass there is little opportunity to attack them. Moths, however, are strongly attracted to light and for *exsiccatus* at least, the attracted individuals are in large part females loaded with eggs; so, for this species, there can be no question as to the value of trap-lights. In changing from grass to some crops where this species is abundant, attention should be given to the life history, as by proper adjustment of time of plowing. The future crops

[1]Lintner: First Annual Report of State Entomologist of New York, p. 187.

[2]Riley: Annual Report United States Department of Agriculture, 1881.

[3]Osborn: Report on Insects of the Season in Iowa, Ann. Rept. U. S. Dep. Ag., 1887.

may be entirely protected, while lack of such attention may expose them to serious damage.

In the Diptera, we may consider the Crane flies as having an important relation to grass crops, but they have not received sufficient attention in this country to enable us to give very satisfactory details of their life history, or to present any established method of attack upon them as pasture pests. Prof. Webster says: "Of the species studied, there is not one the ravages of which can not be almost entirely prevented in young wheat by plowing the ground during late August or early September, and there is every reason to believe that if the fall growth of clover is kept mowed or grazed off during September and October little trouble will likely follow from the depredations of the larvæ the following spring." The Clover-seed Midge and the Clover-leaf Midge, are well-known destructive forms, and in most localities where they were destructive years ago reports indicate that the parasites are now quite effectual in keeping them in check. In localities where they are still destructive the early recommendations regarding the cutting early of the first crop may be considered as useful, but there seems to be some lack of success in this method as generally applied. Some farmers prefer to pasture their clover fields during the first part of the season, on the ground that they prevent the development of the first brood, but if this is adopted, it would seem to me desirable to allow the clover to head and the midges to deposit their eggs, then the turning on of a large number of cattle would insure the destruction of the larvae. I might here call attention to a prevailing opinion that the midge may be transported in clover seed. My own observation is that the midges contained in the clover seed are totally dry and lifeless and do not revive with moisture. It is possible that if they were far enough advanced to assume the pupa stage they might be able to withstand the dryness of the stored seed, but practically this seems not to occur.

The *Meromyza americana* though recognized as a wheat pest has been observed to affect grasses, and is considered in this relation by Mr. James Fletcher.[1]

Among the Coleoptera the Elateridæ furnish us a striking example of adaptation to life in sod land, numerous species being found in grass, and while their depredations are not noticeable because of the underground attacks upon the roots of the plants, we can not doubt that they form a serious drain upon the vitality of the crop. The admirable studies of these insects at the Cornell Experiment Station detailed in Bulletin No. 33 are the most exhaustive investigations yet made of this insect. They are generally supposed to require about three years in their development, and consequently we may expect little damage from them in new pastures. They become very abundant in old sod land, and where such ground is plowed at such time as to favor the further

[1]Report of Entomologist Cent. Exp. Farm (Canada), 1889, pp. 66, 67.

development of the wire worms, the following crop will very likely be seriously affected, whereas an early plowing is said to prove a very complete destruction to the insects and protection to the subsequent crop.

The white grubs form another characteristic group of grass-feeding species, working under ground, often with remarkably destructive results. Recent studies by Forbes, Perkins, and others show that the most, if not all, mature in late summer and remain in the imago stage till spring, and it would seem, therefore, that early fall plowing should be serviceable here as with the Elateridæ. These are parasitized by a fungus described many years since by Prof. Riley, and are also attacked by a species of Isaria which has been studied particularly in France with the view of its dissemination. While there is no question as to the destructiveness of these parasitic fungi, the conditions of their spread in any given field are such as to make it doubtful whether they can be depended on for any extensive destruction of this pest. It has been proven that kerosene emulsion will destroy such larvæ, but expense will limit this method to lawns or very valuable plats.

Among the Hemiptera we have the common Chinch Bug as a grass-feeding species, and its most serious attacks are directed toward the annual grasses, but it seldom proves destructive in pastures or meadows. In the family Jassidæ we have a large number of species that are strictly grass-feeders and mostly abound in meadows and pastures, especially on land which has been for some time in grass. Their work is entirely above the surface of the ground and consists in punctures of the leaves and stems, these punctures resulting sometimes, I believe, in the so-called silver top of blue grass, and in all cases proving a drain upon the plants and, where the insects are numerous, an important loss to the crop. In the genera Deidrocephala and Deltocephalus, eggs are deposited in the leaves or stems, by the fall brood and remain over winter in this location; therefore, burning the grass, or its treatment with kerosene emulsion, is to be considered advantageous. Plowing will also doubtless dispose of a considerable number, but if done at the time when adults can pass into other fields, it can not be considered as a complete method of extermination. There are a number of species of Cercopidæ and Fulgoridæ injurious to grasses, but for most of them only a few details of their habits are known. Aphides affect quite a number of grasses, attacking the roots and stems and leaves, and are for the most part difficult to attack. Such species as migrate to trees and woody plants for winter may possibly be treated with success, when we have more fully determined their habits. Thripidæ occur very commonly in the blossoms of some grasses, and especially in clover. The extent of their damage, however, may be considered as problematic, and from our present knowledge of them there seems to be little opportunity to use any feasible method of treatment.

In the order Orthoptera we meet a large number of species among

the crickets, grasshoppers, and locusts, that are common pasture and meadow pests, feeding above ground upon the leaves and presenting but one brood each year. Most of them deposit eggs in fall, but a few in spring and early summer. Many of them can be attacked directly with good success. While such methods as harvesting, etc., are available in particular cases, it would seem to me an excellent plan to use the tar pan repeatedly along the edges of farm roads or over hard ground where the females congregate to deposit eggs late in the fall, preventing, as far as possible, the deposition of eggs. This might be followed with the ordinary method of plowing such places late in the fall. Aside from these general groups which have been mentioned, there are various species among the other orders, and also a few mites, which may be considered as meadow and pasture pests.

In the discussion of treatment we may consider (1) the natural checks and enemies of grass insects, (2) agricultural methods, and (3) direct methods of attack.

Considering now the agencies for the control of these insects we have as natural agents (1) the climatic conditions, and (2) the natural enemies. It is a matter of common observation that insects, especially such forms as chinch bugs, plant lice, leaf hoppers, etc., are affected by conditions of weather, especially being retarded by cold and wet seasons, so that their injuries at such times may fall far below what would be expected under other conditions. Such conditions of weather can not be controlled, but it is in some cases possible to adapt crops with reference to them, or in case of pasture and meadow to take account of these in the planning of pasturage or regulating the number of animals pastured on a given area. Most of these pests have their natural enemies; a mention of the *Tachinidæ* and *Ichneumonidæ*, *Acaridæ*, and of various birds, rodents, and insectivorous animals would be sufficient to indicate the sources of benefit. It may be well to emphasize, however, the importance of frogs, moles, skunks, raccoons, and so far as the pastures are concerned, the common striped squirrels as agents in the destruction of grasshoppers, cutworms, wireworms and many other of the pasture pests, and we may also expect some help through the various fungi which tend to propagate and distribute themselves.

AGRICULTURAL METHODS.

Under this head we may place such methods as cropping, and also the regulation at times of plowing and harvesting, etc., which are for the purpose of affecting certain insects. These must necessarily depend on the life histories of the insects which it is intended to attack. There is naturally the probability of the presence of a number of different kinds of insects on the same land, and frequently treatments must be planned separately for the different species. In some cases, however, a method may be adapted to affect a number of different

insects in one treatment. It is therefore desirable that the cultivator should be able to recognize insects sufficiently at least to know which are more serious at a given time and act accordingly. First among such methods we may consider that of plowing with the intention of planting the ground with a different crop.

For many of the insect pests there is no very practicable method to apply on a large scale except to plow up the land and put it in some other crop for a year or two. The habits of many of the species are such that they do not become numerous or particularly injurious in grass land until three or four years at least after planting to grass. Wire-worms, cut-worms, white grubs, bill-bugs, and also many of the Jassidæ, Cercopidæ, Fulgoridæ, and Acridiidæ increase in number from year to year until the grass is much reduced in vitality. Such grass land is commonly considered to be run out and often thought by cultivators to have exhausted the soil for grass or to have lost its vitality. In reality, I firmly believe this running out is more often due to the increase of insects, both subterranean and leaf feeding. The main point to be accomplished when a change to another crop is necessary or practicable is to arrange the transfer so as to avoid injury to the subsequent crop. Reference to our table will show that for the cutworms, wireworms, white grubs, and to some extent probably for the Hemipterous and Orthopterous insects, by far the greater protection to the following season's crop is procured by an early fall plowing—a conclusion which is supported by practical experience and may, I think, be considered thoroughly established. As to times of harvesting, we have in the case of the Clover-seed Midge, Clover-seed Caterpillar, Wheat-head Army-worm and some other species much to warrant us in the conclusion that early cutting of the crop with prompt storage will accomplish much in the destruction of these insects while still immature.

The use of fertilizers may be also considered under this head. For much of the western country any use of commercial fertilizers is hardly to be considered a practicable mode of treatment, but where the use of fertilizers upon grass land is in practice, the use of fertilizers which have insecticidal properties is no doubt an important means of contending with insect enemies. The value of such materials has been strongly urged by Prof. Smith, who cites experiments indicating the destruction of wireworms by the use of kainit.

In cases where a change is to be made to some other crop, and particularly where it is desired to continue a field in grass, trials of this substance may well be made with special reference to its insecticidal value.

DIRECT METHODS.

Direct methods of attack on grass pests will doubtless always be the most difficult to enforce. The average farmer seldom appreciates the importance of adopting such means sufficiently to use any method requiring extra labor or expense. While ready to resort to the rota-

tion of crops or other measures which often really involve a greater outlay or loss, he dislikes to adopt measures unfamiliar or involving special study which may be really effective. In general it may be said that root-infesting species are protected from direct attack in the destructive stages. While it has been shown that such larvæ may be destroyed by the use of kerosene emulsion, such applications in quantities sufficient to destroy the larvae beneath the surface of the ground would not be considered of general practicability. Many of these species however may be attacked at other stages. Nociuids and Pyralids are attracted by lights, and some of them certainly prior to egg laying, so that for certain species trap lights may be recommended. Elateridæ may be destroyed in the adult stage by the use of arsenical baits; Lachnosterna may to some extent be affected by spraying the trees with arsenical solution, and some of the root-infesting Aphids by the destruction of their spring generations on woody plants. For the species feeding upon the stems, leaves, and seeds of plants, applications must depend upon the insect and the nature of its attack. In some cases, we believe a broadcast spraying of the arsenites for leaf-feeding species and of kerosene emulsion for suctorial species might be applied with profit. For grasshoppers and leaf hoppers the use of the tar pan, a method which has proven very successful, may be recommended. This process is perhaps worthy of most extended recommendation, and there can scarcely be a doubt that its general adoption upon pasture and meadow lands would result in great profit. It is also quite certain that for many species eggs are laid in the grass in autumn, and late fall or early spring burning will prove of great advantage if conditions will permit adoption of this plan.

In the most general way, therefore, we may recommend—

(1) A general rotation of crops, especially for clover and for meadows generally, and change at the end of four or five years at the most.

(2) Where it is desirable to keep the same field continually in grass or for a long series of years, as in rough land or woodland pastures, attention to the maintenance of trap lights, the use of arsenical baits or applications, burning, and the tar pan should be practiced, especially after the second year.

(3) To allow ground squirrels, moles, and other natural enemies to carry on their work unmolested, and in case their multiplication affects surrounding crops to adopt means of protecting such crops without destroying these animals. If in localities where fertilizers may be used with profit, to adopt the use of such kinds as may have insecticidal properties.

Seasons and states of insects in

	Food plant and part of plant.	Annual broods.	December. January. February.	March.	April.
Colias philodice [1]	Leaves of clover.	2	Pupa	Pupa	Imago
Colias eurytheme	Clover leaves	2	Pupa	Pupa	Imago
Colias cæsonia	Clover	2	Pupa	Pupa	Imago
Terias lisa	Clover	2	Pupa	Pupa	Imago (?)
Debis portlandia	Wild grasses	1	Larva	Larva	Larva
Neonympha eurytris	Grass	2 (?)	Larva	Larva	Pupa, im. (?)
Neonympha canthus	Grass	1	Larva	Larva	Larva
Pamphila mystic	Grass	1	Pupa	Pupa	Pupa
Pamphila peckius	Grass	1	Pupa	Pupa	Pupa
Pamphila sassacus	Grass	1	Pupa	Pupa	Pupa
Pamphila zabulon	Grass	1	Pupa	Pupa	Pupa
Amblyscirtes vialis	Grass	1 (?)	Pupa	Pupa	Pupa (?)
Amblyscirtes samoset	Grass	1	Pupa	Pupa	Pupa
Eudamus pylades	Clover	1	Pupa	Pupa	Pupa
Spilosoma acræa [2]	Grass	1 or 2	Pupa	Pupa	Pupa
Spilosoma isabella	Clover, etc	1	Larva	Larva	Pupa
Agrotis bicarnea	Grass	1	Larva	Larva	Larva
Agrotis messoria	Grass, etc	1	Larva	Larva	Larva
Agrotis saucia	Clover	1	Imago	Imago	Eggs
Hadena devastatrix	Grass	1	Larva	Larva	Larva
Hadena lignicolor	Grass	1	Larva	Larva	Larva
Prodenia commelinæ	Clover, etc	1 (?)	Larva, pupa, imago.	Larva, pupa, imago.	Larva, pupa, imago.
Nephelodes violans	Clover, grass, etc.	1	Larva	Larva	Larva
Laphygma fuigiperda	Grass, etc	2 or more	Larva or pupa.	Pupa	Imago
Leucania albilinea	Timothy, wheat, grasses.	2	Pupa	Pupa	Pupa
Leucania unipuncta	Grasses.	1 or 2	Imago or pupa.	Imago	Eggs
Drasteria erechtea ?	Clover, grass, etc.	3	Pupa	Pupa	Pupa
Drasteria crassiuscula [3]	Grass and clover.	3 (?)	Pupa	Pupa	Pupa
Asopia farinalis	Clover hay, etc.	1	Larva	Larva	Larva
Asopia costalis	Clover hay	1	Larva	Larva	Larva
Crambus exsiccatus	Blue grass and corn.	2	Larva	Larva	Larva
Crambus vulgivagellus	Grass	1	Larva	Larva	Larva
Nomophila noctuella [4]	Clover and grass.	3 (?)	Larva	Larva	Larva
Grapholitha interstinctana	Clover seed and leaves.	3	Larva	Larva	Pupa
Cecidomyia leguminicola	Clover seed	2	Pupa	Pupa	Pupa
Cecidomyia trifolii	Clover leaves.	2 (?)	Pupa	Pupa	Pupa
Meromyza americana	Wheat and grass stems.	2	Larva	Larva	Pupa
Cryptohypnus abbreviatus	Grass		Larva, imago.	Larva, imago.	Larva, imago.
Melanotus communis	Grass	3 years (?)	Larva, imago.	Larva, imago.	Larva, imago.
Agriotes mancus	Grass, etc	1 brood in 3 years (?)	Larva, imago.	Larva, imago.	Larva, imago.
Asaphes decoloratus	Grass	1 brood in 3 years (?)			
Drasterius elegans	Grass				
Lachnosterna fusca *et al.*	Grass	1 brood in 3 years.	Larva, imago.	Larva, imago.	Larva, imago.
Sitones flavescens	Clover	1 (?)	Imago (?)	Imago (?)	Imago (?)
Sphenophorus parvulus	Grass	1	Imago	Imago	Imago
Blissus leucopterus	Hungarian grass, wheat, etc.	2	Imago	Imago	Imago
Calocoris rapidus	Clover	2	Imago	Imago	Imago
Lygus pratensis	Clover, etc	2	Imago	Imago	Imago
Diedrocephala mollipes	Grass	2	Eggs	Eggs	Eggs, larva

[1] Fernald. Butterflies of Maine, p. 31.
[2] Harris. Insects Injurious to Vegetation, p. 351.
[3] Slingerland. *Ins. Life.* Vol. v, p. 87.
[4] Felt, E. P. *Canad. Entom.* 1893. Vol. xxv, p. 129.

juring grasses and forage crops.

May.	June.	July.	August.	September.	October.	November.
Larva	Larva	Pupa	Imago	Imago, larva	Larva	Pupa.
Larva	Larva	Pupa	Imago	Imago, larva	Larva	Pupa.
Larva	Larva	Pupa	Imago	Imago, larva	Larva	Pupa.
Larva	Larva	Pupa	Imago	Larva	Larva	Pupa.
Pupa	Pupa	Imago	Larva	Larva	Larva	Larva.
Larva (?)	Larva (?)	Imago	Imago, larva	Larva	Larva	Larva.
Larva (?)	Pupa	Imago	Larva	Larva	Larva	Larva.
Pupa	Imago	Imago	Larva	Larva	Larva	Pupa.
Pupa	Imago	Imago	Larva	Larva	Larva	Pupa.
Pupa	Imago	Imago	Larva	Larva	Larva	Pupa.
Pupa	Imago	Imago (?)	Larva	Larva	Larva	Pupa.
Pupa (?)	Pupa	Imago	Larva	Larva	Larva	Pupa.
Pupa	Imago	Larva	Larva	Larva	Larva	Pupa.
Pupa	Imago	Larva	Larva	Larva	Larva	Pupa.
Pupa	Imago	Larva	Larva	Larva	Pupa	Pupa.
Pupa	Imago	Imago	Larva	Larva	Larva	Larva.
Pupa	Pupa	Imago	Imago	Imago, eggs	Larva	Larva.
Pupa	Pupa	Imago, eggs	Imago, eggs	Larva	Larva	Larva.
Larva	Larva	Larva, pupa	Imago	Imago	Imago	Imago.
Larva	Pupa, imago	Imago	Imago, eggs	Imago, eggs, larva.	Larva	Larva.
Pupa	Imago	Imago	Eggs	Larva	Larva	Larva.
Imago	Imago	Larva (?)	Larva	Larva	Larva	Larva.
Larva	Pupa	Pupa	Imago	Imago, eggs	Larva	Larva.
Larva	Larva, pupa	Imago	Larva	Larva, imago	Imago, larva	Larva or pupa.
Imago	Eggs, larva	Larva, pupa	Imago	Larva	Larva	Pupa.
Eggs	Larva	Larva	Pupa, imago.	Imago	Imago	Imago.
Imago	Larva	Imago (?)	Larva	Imago	Larva	Pupa.
Imago	Larva	Imago	Larva	Imago	Larva	Pupa.
Larva, pupa	Pupa	Imago	Imago	Eggs, larva (?)	Larva	Larva.
Larva, pupa	Pupa	Imago	Imago	Eggs, larva (?)	Larva	Larva.
Larva, pupa	Imago	Larva	Larva	Imago	Larva	Larva.
Larva	Larva	Pupæ	Imago	Larvæ	Larva	Larva.
Imago (?)	Larva (?), imago.	Larva	Imago	Imago	Larva	Larva.
Imago	Larva	Pupa, imago.	Imago, larva	Larva, imago	Larva	Larva.
Imago	Larva	Pupa	Imago, larva	Larva	Pupa	Pupa.
Imago (?)	Larva, pupa, imago	......	......	......	......	
Imago	Larva	Larva, imago	Imago, larva	Larva, imago	Larva	Larva.
Larva, imago	Larva, eggs (?)	Larva, larva	Larva, pupa	Larva, pupa	Larva, imago.	Larva, imago.
Larva, imago	Larva, eggs (?)	Larva, larvæ.	Larva, pupæ	Larva, imago.	Larva, imago.	Larva, imago.
Larva, imago.	Larva, eggs (?)	Larva, larvæ	Larva, pupa.	Larva, imago	Larva, imago.	Larva, imago.
......	......	......	......	......	......	
......	......	......	......	......	......	
Larva, imago.	Larva, imago.	Larva, larva	Larva, larva	Larva, imago.	Larva, imago.	Larva, imago.
Imago	Imago	......	......	......	......	
Imago	Imago, larva.	Larva	Pupa, imago.	Imago	Imago	Imago.
Larva	Larva	Larva, imago	Imago, larva	Larva	Larva, imago	Imago.
Larva	Larva	Imago	Imago, larva	Larva, pupa.	Imago	Imago.
Imago, larva.	Larvæ	Imago	Imago, larva	Larva, imago	Imago	Imago.
Larvæ	Imago	Imago, larva	Larvæ	Imago	Imago	Eggs.

Seasons and states of insects in

	Food plant and part of plant.	Annual broods.	December. January. February.	March.	April.
Deltocephalus inimicus	Blue grass	2 or 3 (?)	Eggs	Eggs	Eggs
Deltocephalus debilis	Blue grass	2	Eggs	Eggs	Eggs, larvæ.
Lepyronia 4-angularis	Grass	1 or 2	Eggs (?)	Eggs (?)	Larva (?)
Philænus (Ptyelus) lineatus	Grass	1 or 2	Eggs (?)	Eggs (?)	Eggs (?) or larva.
Phlœothrips nigra	Clover	2 (?)	Larva	Larva	Larva, im.(?)
Thrips tritici	Clover, etc	2 (?)			
Limothrips poaphagus	Grass				
Xiphidium fasciatum	Clover and grass.	1	Eggs	Eggs	Eggs
Melanoplus femur-rubrum	Grass, clover, etc.	1	Eggs	Eggs	Eggs
Melanoplus differentialis	Grass, clover, etc.	1	Eggs	Eggs	Eggs
Melanoplus atlanis	Grass, clover, etc.	1 or 2	Eggs	Eggs	Eggs
Melanoplus spretus	Grass, clover, etc.	1	Eggs	Eggs	Eggs, larva.
Acridium spp	Grass	1	Imago	Imago	Eggs
Dissosteira carolina	Grass	1	Eggs	Eggs	Eggs
Hippiscus spp	Grass, etc	1	Imago	Imago	Imago
Tragocephala spp	Grass, etc	1	Larva, pupa.	Larva, pupa.	Pupa, imago.

juring grasses and forage crops—Continued.

May.	June.	July.	August.	September.	October.	November.
Larvæ	Larva, imago	Imago, larva	Larva, imago	Imago(?)	Imago	Imago, eggs (?).
Larvæ	Larvæ imago	Imago, larva	Larva, imago	Imago, larvæ(?)	Imago larvæ(?)	Imago, eggs.
Larva	Imago	Imago				
Larva	Imago	Imago				
Imago	Imago, larva	Larva, imago	Larva, imago	Imago, larva	Imago (?) larva.	L.
Imago	Imago	Larva, imago	Larva, imago	Imago		
Egg, and larva(?).	Larva	Larva, pupa	Imago	Imago	Imago, eggs	Eggs.
Egg, larva	Larva	Larva	Larva, imago	Imago	Imago, eggs	Eggs.
Egg, larva	Larva	Larva	Larva, imago	Imago	Imago, eggs	Eggs.
Eggs and larva.	Larva	Larva, imago	Larva, imago, eggs.	Imago, eggs	Imago, eggs	Eggs.
Larva	Larva, imago	Larva, imago	Imago	Imago	Imago, eggs	Eggs.
Larvæ	Larvæ	Larva, imago	Larva, imago	Imago	Imago	Imago.
Larva	Larva	Larva, imago	Larva, imago	Imago	Imago, eggs	Eggs.
Imago and eggs.	Larvæ	Larvæ	Larvæ	Imago (?)	Imago	Imago.
Imago	Imago, eggs	Eggs	Larva	Larva	Larva	Larva, pupa.

AUTHORS CONSULTED.

COMSTOCK, J. H. Bulletins Cornell Univ. Exp. Station. Introduction to Entomology.

EDWARDS, H. Bibliog Catalog. of Described Transformations of North American Lepidoptera. Bulletin of the U. S. Nat. Mus. No. 35.

FERNALD, C. H. Butterflies of Maine.

FLETCHER, JAMES. Reports of Entomologist Central Experimental Farm, Canada.

FORBES, S. A. Reports of State Entomologist, Illinois.

FRENCH, G. H. Butterflies of the Eastern United States.

GILLETTE. Bulletins Iowa Experiment Station (especially No. 12).

HARRIS, T. W. Insects Injurious to Vegetation.

LINTNER, J. A. Reports of State Entomologist of New York.

OSBORN, HERBERT. Ann. Rept. U. S. Dep. Ag. 1887. Bulletins 22 and 23, Div. Ent. U. S. Dep. Ag. Bulletins Iowa Exp. Station.

PERKINS, G. H. Annual Repts. Vermont Experiment Station.

RILEY, C. V. Reports State Entomologist of Missouri. Reports Entomologist U. S. Dept. Agriculture. Bulletins Div. Ent. U. S. Dept. Ag. (especially No. 25).

SLINGERLAND, M. V. Bulletins Cornell Univ. Experiment Station.

WEBSTER, F. M. Bulletins Ohio Experiment Station.

In discussing this paper Mr. Hopkins stated that he had not studied the insects mentioned by Mr. Osborn as causing the failure of grass fields, but that he had observed that if land on which grass is "run out" is plowed in July and sown to grass seed by the first week in August a good crop of hay would be obtained the next July, and that the crop gradually diminishes from year to year until this treatment is repeated.

The following paper was then read:

NOTES ON METHODS OF STUDYING LIFE HISTORIES OF INJURIOUS INSECTS.

By L. O. HOWARD, *Washington, D. C.*

In the pamphlet entitled "Directions for Collecting and Preserving Insects," published by Dr. Riley as Part F, Bulletin 39, of the National Museum, the chapter on "The Rearing of Insects," occupying pages 112 to 120, comprises in general and in condensed form the results of the experience of the office with which I am connected. Excellent remarks will be found under the heads of "General Directions," "The Breeding Cage or Vivarium," and "Detailed Instructions for Rearing," together with some consideration of the root cage, special apparatus, and the insectary. Under the head of "Detailed Instructions for Rearing," the greatest attention is paid to the best methods of studying the life histories of Lepidoptera, but the subjects of out-door observations of insects possessing alternate food plants, such as the Aphi-

didæ, and of insects susceptible to confinement, such as the Tenthridinidæ, are considered but briefly, and there are a few other points not treated in detail, for lack of time or space. It will be proper then for me to present, not a full discussion of methods, but certain notes on methods supplementary to the bulletin mentioned. My own personal experience in the rearing of insects has been slight, and the facts which I shall give are derived solely from observation of the methods in use in the Division of Entomology, where they have been introduced by Prof. Riley, and where they are being carried on by his able and conscientious assistant in charge of the insectary, Mr. Theo. Pergande.

There is probably no group of insects more difficult to study than the Aphididæ. Susceptible to changes of temperature and to excess or lack of moisture, attacked by a host of natural enemies, and possessing generally alternate food plants, they are apt to foil the best meant endeavors to observe their life round. Dr. Riley has, however, mainly with the coöperation of Mr. Pergande, been able to fill out the numerous gaps in the life histories of many species and to record in full those of others new to biological literature. This has only been done by the patient labor of years and by the exercise of foresight and ingenuity to a most marked degree. Take the case of the Hop Plant-louse (*Phorodon humuli*), for example. The starting point in this study was the suspected, though not perfectly proved, identity of the form on Prunus and the form on Humulus. Nearly all of the observations were made in the field and very much in the following manner: During the winter, winter eggs supposed though not known to be those of this species were marked by the hundred upon plum trees. With the bursting of the buds in the spring the marked eggs were examined. Hardly one out of a hundred was found to hatch, the others having been destroyed by predaceous insects or killed by the action of the weather. A number of stem-mothers were followed to their settling point; the leaf was marked, but at first was not inclosed in netting, as it was feared that this might interfere to some slight extent with the proper growth of the foliage. Each morning the offspring of each stem-mother were counted and were carefully removed with a camel's hair brush and placed upon adjoining leaves which were given characteristic markings. Thus the total number of offspring was ascertained and a supply of definitely known individuals of the second generation was provided for. In the same way the individuals of this second generation were followed, and as they began to give birth to their living young each one was visited every morning and the offspring of the previous day and night were removed, a sufficient number being stationed upon marked leaves to carry the investigation forward, while the rest were destroyed. At this stage of the investigation it became necessary to inclose individual leaves with netting in order to prevent the presence not only of predaceous insects but of other individuals of the plant lice which would prove disturbing elements and would be liable to confuse the investi-

gator. An accurate count of every individual within each net bag was kept and, as a matter of course, before the transplanting could take place every square millimeter of leaf surface which was to be inclosed was gone over with a lens to make sure of the nonpresence of other individuals. This course was followed with the succeeding generation, and on the appearance of the winged generation the Plum was by no means abandoned. Winged individuals were confined for days upon this plant to see whether they would deposit young upon its leaves and to see whether these young would fix themselves and procreate.

The simultaneous appearance of winged individuals absolutely indistinguishable from those upon Plum upon the Hop and the failure of the confined offspring of plum migrants to settle in a normal manner obviated the necessity for a direct observation upon the actual passage through the air of winged individuals from Plum to Hop, although, as a matter of fact, the return migration was readily observed from the greater number of individuals. Taking up the same course of observations upon the Hop, individual leaves were carefully cleaned under the lens, marked and stocked, and inclosed with netting. Every morning the young were counted and removed, some destroyed and some established upon cleaned leaves, and so the insect was followed day after day throughout the entire summer, the exact number of generations found, the exact intervals of the winged generations, the exact point at which the sexual individuals appeared, the exact number of offspring of a considerable number of females of each individual ascertained, and the return flight to Plum observed.

Here the return migrant females were carefully watched in the same manner as before until they gave birth to the true sexual females, the number of molts was counted, the number of offspring ascertained, and the latter were isolated, and watched almost every minute to full growth. In the meantime the development of the male, which is winged, was also watched on Hop in similarly isolated individuals. Its migration to Hop was in turn followed and a certain number were introduced into the receptacle containing the isolated females. Thus the birth of the oviparous females was observed, the latter were isolated, and egg-laying watched.

These observations were necessarily carried out in a single locality and almost entirely by Mr. Pergande. Independent and fully corroborative observations were also conducted by Mr. W. B. Alwood simultaneously with his remedial work. I myself examined the progress of the work during a field visit and Dr. Riley took the field on several occasions to satisfy himself of the satisfactory progress of the investigation. So far for a single locality (Richfield Springs, N. Y.). The bulk of the work was done there. But it was necessary with so widespread a species to study its life-history at other points. Prof. Riley was able to do this personally in the hop fields of England and the south of France. Prof. Osborn was sent to the hop-growing regions of

Wisconsin, and, since the advent of the species upon the Pacific Coast, its life-round has been followed by Mr. Kœbele in the hop-yards of Oregon and Washington.

It will be seen from this account that the labor involved in a series of observations of this kind, which resulted in the satisfactory ascertaining of the life-history of but a single species, is something enormous, and at the same time I believe that no fault can be found with the methods used.

Where from lack of time, or from other reasons, out-of-door work upon plant lice is impossible, good results may be obtained in the insectary, provided an abundant supply of the leaves of the food-plant is available. For instance, the present summer Dr. Riley is having a study made of the life-history of a species commonly found upon the tulip tree. The summer generations are being followed up in this way: To each female under observation a glass tube 4 inches long by 1 inch in diameter is devoted. Every day a large freshly plucked leaf is cut with the shears into a square of about 3 inches each way. It is carefully cleaned with the brush on both sides, folded into a cylinder and thrust into the tube. The Aphidid is carefully removed from the old leaf by means of a camel's hair brush and placed within the cylindrical fold of the fresh leaf. A stopper of cotton is then thrust in and the tubes as soon as prepared are placed in a jar and removed to the basement, where they are kept at a constant temperature until the following day, when the process is repeated. Extremes of temperature are fatal to the plant lice, and I well remember one hot July day in 1888 when probably 999 out of every 1,000 plant lice on the shade trees in Washington were destroyed by the heat. This operation of removal can not be done too carefully, else the beak will be broken off. The change of food every twenty-four hours is absolutely essential, otherwise the drying of the leaf holds the beak so that it is impossible to remove the insect. By this method the number of young deposited each day and the number of molts undergone by each individual may be counted quite as readily and in fact a little more so than in the bags on the plants.

The study of Coccidae in the insectary is a simple one to the trained observer when the food plant can be grown and the insects colonized upon it; otherwise it becomes an impossibility, since, after the first molt, these insects can not safely be removed from their food. Most of the species remain stationary or nearly so, and their location can easily be recorded, the exact situation of each individual under observation being circumscribed by a ring of ink marked with a pen upon the leaf. The rate of travel of those individuals of species which do move slowly up to the adult stage may be determined in the same way.

All earth used in the insectary should be sterilized and sifted. This is necessary in order to destroy disease germs, in order to subsequently regulate the amount of moisture, and in order to destroy predaceous mites and also other insects which might be causes of danger or of con-

fusion. We prepare earth readily and in bulk in a galvanized iron oven $2\frac{1}{2}$ by $1\frac{1}{2}$ by 1 foot. The cover is roof-shaped and lifts off by a central handle. There is a circular orifice in this cover to emit steam and consequently to facilitate drying. The oven stands on legs $1\frac{1}{2}$ feet high (the height being simply for convenience in handling) and it is heated by a single gas jet from a Bunsen burner placed upon a support beneath. After, say, two hours, heating the moisture becomes dissipated, the earth becomes dry and is readily sifted. It is then passed through two sieves, the larger one being 6 to the inch and the smaller one 18 to the inch. It is then in proper condition to use either in large boxes for underground insects or in the ordinary breeding jars or cages.

The mention of underground insects reminds me that we have found the Comstock root cage a very excellent apparatus in theory but a difficult one to use in practice. The insects can not be observed, even when close to the glass side, to any advantage, since, with the slightest moisture, the earth becomes firmly packed against the glass, forming a layer which can not be penetrated by the eye. We have, therefore, found it more simple to rear subterranean forms in wooden boxes 2 by 2 feet by 8 or 9 inches deep, the bottoms perforated with a few auger holes covered with wire netting and containing a good supply of grass or other food plant growing. These boxes are also made of smaller dimensions and, with a good supply prepared, the earth is removed at intervals from some and the condition of the contained insects observed. It is worthy of remark that with grass-root-feeding scarabs, such as Allorhina and Lachnosterna the grass crop must be kept healthy, or as soon as it dies, they must be transferred to fresh boxes with vigorous plants.

These same boxes make excellent rearing cages for certain insects attacking field crops. Four supports in the shape of laths are nailed to the four corners of the box and a tarletan or other gauze covering is constructed to fit over in such a way as to be fastened at the sides of the box. The flap is left for the introduction of insects, and after the adults have oviposited and died the cover may be removed and the work of the immature stages observed at leisure. This arrangement, and the Riley breeding cage which has so often been figured and described, are the larger vivaria. Great use is made, however, of glass vessels of every size, from the small test tube, one-fourth of an inch in diameter by two inches long, to the large glass cylinder 18 inches high by a foot in diameter. One of these glass cylinders placed upon the slate table of the insectary, partly filled with sterilized earth and covered with a cloth held in place by a string or rubber band, makes an excellent breeding cage for certain insects. Battery jars, Mason's fruit jars, jelly jars, quinine and morphine bottles and collecting tubes, all find their proper use.

Another important rearing apparatus is the aquarium. Many styles of aquaria have been described and are on the market. Certain special

features adapting it for insect rearing, however, have been introduced by Mr. Pergande, and the result in our own case is very satisfactory. Two glass aquaria each 2½ by 1½ by 1½ are placed end to end, the one elevated on a three-inch base so as to make it that much higher than the other. The water connections from the one to the other are so arranged that each may be independent of the other, and the details are simply arranged. In each a V-shaped inclined glass septum with a broad deflexed lip, and beneath this lip has been constructed an artificial rock-work grotto. The water enters the first aquarium through a T sprinkler with six pipette orifices. It drops a distance of 6 or 8 inches into the V-shaped septum and its force is easily graduated by stop cocks. Rising to the height of the deflexed lip it pours in a broad cascade into the main compartment, impinging on the top of the rock-work grotto. The second or lower aquarium is at present similarly arranged, and derives its supply of water either from the overflow of the first or independently from an overhead pipe, so that its water may be kept either still or running at will. Thus we have arrangements in a small space for the rearing of all kinds of aquatic insects. The sliding stream upon the artificial rock-work is particularly adapted for such forms as Simulium, and opportunity is also offered for such species as have the habit of crawling out either on rocks or earth, as the case may be.

One of the difficulties encountered in the rearing of insects is the proper maintenance of the right degree of moisture. Galls of all kinds, whether cynipid, cecidomyiid, or trypetid, are apt to be left either too dry, in which case the issuing of the adult is delayed far beyond the normal time, or too moist, in which case they become covered with mildew and spoil. If the jar containing them be left open they dry, no matter if sprinkled frequently. If the jar, on the contrary, be stoppered, mildew soon puts in an appearance. This difficulty is obviated by keeping all galls in a series of jars at the same height, the mouths of the jars being covered with gauze to prevent the escape of the adults or of parasites. Over the whole series is laid a large sheet of blotting paper. The blotting paper is moistened daily, and gall in insects seems to thrive under this treatment. Mildew seldom appears, and the insects emerge on time. This same plan is a good one for certain tineids.

The subject of moisture in the rearing of lepidopterous larvæ has been frequently considered, and it is a tolerably well-known fact that it is disastrous to feed these larvæ wet foliage. Spraying the leaves upon which they are at work has been practiced, but both practices result in a diarrhœic disease which carries off whole colonies, just as the same course is followed by the same trouble with the domestic silkworm. As a matter of fact, lepidopterous larvæ do not feed during a rain or upon wet foliage out of doors, as many observers will testify.

For such larvæ as feed upon growing foliage, it is absolutely essential to change the food every twenty-four hours, since while they will feed, in the absence of fresh food, upon drying leaves, this results in constipation and probable consequent febrile symptoms. At the time of renewing the food it is essential to carefully wipe out the jars or the cages.

Clean, sterilized, and sifted sand is perhaps the best substance to use in the bottom of breeding cages and for most larvæ which hibernate underground to enter for pupation. After such insects have gone down it should be kept reasonably moist by occasional sprinkling, and a free current of air should be admitted to the surface.

Of all larvæ none are more difficult to rear than those of Tenthredinidæ. Their mouth-parts seem to dry unless constantly lubricated by the saliva induced by mastication, and once dried the larva usually dies. So when received by mail from a distance it is usually impossible to rear them. They wander restlessly over the food, leave it, crawl about and die. Even when transferred, with their food, directly to the breeding cage they are usually dissatisfied and restless. Fresh food must constantly be supplied, and if possible they must not be allowed to descend to the surface of the sand, or the latter must carefully be covered with paper or blotting paper; for if they once close their prolegs on a grain of sand, they hold it convulsively and it is almost impossible to dislodge it, so that they are practically unfitted for again clasping a twig.

Acridiidæ are most difficult insects to rear. Confined in a breeding cage of the ordinary dimensions, they feed little and are apt to fatally exhaust themselves in futile efforts to escape. Therefore they should be inclosed in a large gauze-covered inclosure, say 3 feet square, and in the earth should be growing not only grass but also weeds of various sorts, such as Astragalus, Amaranthus, and Rumex. Their close allies the Locustidæ are, on the contrary, very easy to rear in confinement and need only be given an occasional supply of fresh food to flourish even in close quarters. So also with the Phasmatidæ and Mantidæ. The latter require no moisture whatever, beyond that which they get from the bodies of their victims.

In rearing hymenopterous parasites the jar should be tightly closed and an occasional narrow strip of moistened blotting paper inserted. Or they may be inclosed in glass tubes with tight absorbent cotton stoppers, the stoppers being occasionally moistened. Bees, such as Megachile, need very little moisture and give little trouble in rearing. Stalk-borers of all kinds may, as a rule, be kept perfectly dry or only moistened somewhat every two or three weeks. Plant-feeding Heteroptera need simply plenty of fresh food and will take care of themselves, with comparative indifference as to their surroundings. Certain other coleopterous larvæ, such as most of those of the adephagous series, should be

kept in large glass jars with no cover whatever, as they seem to require plenty of fresh air.

All of these indoors and rearing-cage notes, however, concern things which will gradually be learned by experience, and after all, with the majority of insects, nothing can take the place of outdoor work. I have given with so much detail in the early part of this paper the methods used in the investigation of *Phorodon humuli*, mainly to emphasize this point. More particularly the case with Aphididae and Cynipidae, since these forms exhibit an alternation of food plant or an alternation of generation, the rule holds in only slightly lesser degree with all forms of insect life. To gain the clearest and most accurate idea of a life history the insect must be studied under perfectly natural conditions, and not under conditions which more or less imperfectly simulate the natural ones. There is no easy road to the most perfect knowledge of habits. It involves tramping through mud and bramble patches; it involves the constant risk of sunstroke, and in our Southern country the constant presence of Leptus and Ixodes; it involves constant watching and watching and watching, astride the small limb of a fruit tree, perhaps, on your back under bushes, on your knees in the wheat field, on your stomach in the pasture, with your face down close to a cow's dropping, and with the summer sun beating down upon your unprotected head, watching and watching until your eyes grow dim; but in this way only are the unsolved problems in the life histories of injurious insects most satisfactorily worked out.

Mr. Forbes wished to know how close Mr. Howard found it possible to keep the temperature of the insectary to the out-of-door temperature, and suggested the electric blower as a means of ventilation. Mr. Howard thought that by proper contrivances for admitting air the temperature might be kept practically the same as that outside.

Mr. Forbes thought that work on the life histories of insects carried on indoors should be verified constantly by observations on the same insects in their natural haunts.

Mr. Garman suggested that some insects were much more influenced by being kept indoors than others, and stated that he has sometimes been surprised to find that insects kept in a dry and heated room went through their stages at the same times as those out-of-doors.

The following paper was then read:

ANOTHER MOSQUITO EXPERIMENT.

By L. O. Howard, *Washington, D. C.*

Just as "one swallow does not make a summer," one experiment does not fully satisfy the economic entomologist of the value of a remedy. At the last meeting of this association I laid before you the facts concerning an experiment in applying kerosene oil to the surface of a mosquito breeding-pool and argued from its results that in many localities where the breeding places are circumscribed the mosquito plague may be largely averted.

The publication of this paper excited considerable interest in the subject and brought me some little correspondence from individuals who considered themselves advantageously located for the testing of the remedy on a larger scale than I had been able to attempt. Dr. Wooster Beach, of New York City, wrote last fall that it appeared to him quite possible to treat large tracts of land in the manner proposed, and solicited Government aid in locating breeding places in Westchester County along Long Island Sound, provided he could interest property holders and raise a small fund to be expended in the purchase of kerosene and the wages of men to apply it under expert supervision. The necessary aid was promised him, with Dr. Riley's sanction, and he made a strong effort to arouse the popular interest by articles in the local papers; but either through nonsusceptibility to mosquito poison on the part of his neighbors, or through indifference arising from other causes, he failed to collect the fund, and an interesting experiment on a large scale was thwarted.

Another very satisfactory experiment upon a small scale, however, has been made the present season. But before recounting the facts in the case I must advert to the chronic disinclination on the part of the property holders of a given neighborhood to admit that they are troubled by mosquitoes. I spoke in INSECT LIFE last fall of a New Jersey mosquito remedy, recounting the killing by its means of seventy-five mosquitoes on the ceiling of my room in a New Jersey town, the name of which I thoughtlessly published. By the next mail after the issue had reached that part of the country I received letters from two residents of the town warning me that I would be mobbed by the inhabitants if I ever set foot in the place again, that is, provided my note should happen to be republished in some more widely read journal than INSECT LIFE. New Jersey and mosquitoes had been coupled in my mind since earliest boyhood, and I was totally unprepared to learn that our cultivated and refined neighbors were sensitive on the point.

However, after this experience I was not surprised to find that the gentleman who conducted the experiment which I am about to detail desired his name, and particularly his locality, to be kept from the public eye. I may state, however, that it is within two hours' ride

from the city of Washington, and that I have had an opportunity to verify the condition of affairs as reported to me.

The gentleman in question had seen in one of the newspapers some account of my Catskill Mountain experiments and wrote me through a mutual friend in Washington for detailed advice in his own case. Correspondence elicited the fact that the mosquito supply must come from a small mill pond one-eighth of a mile from his house, from a small, marshy tract above the pond, and from two horse troughs, one at his barn and the other at the roadside in front of his house. He had also a large rain-water barrel for which he immediately had a cover constructed at my advice.

The horse troughs were readily freed from "wrigglers" by using a small fine-meshed hand net every few days, and the kerosene treatment was used for the mill pond and the marsh. Estimating the surface area of the pond at 4,000 square feet, he sprinkled on 15 gallons of the cheapest kerosene. This formed a continuous layer, and remained evident to the senses, in the absence of rain, for two weeks. Three weeks after the application, which was made on the 4th of June, I visited the place and found that the kerosene was still operative, although a slight shower had fallen on the seventeenth day. No trace of a living aquatic larva of any kind could be found, and the surface of the pond was thickly strewn with dead aerial insects, among them many female mosquitoes.

A few straggling living mosquitoes were noticed about the house the first week in June, but none subsequently, and although the treatment was not repeated none have been reported to have appeared during July.

The small marsh pools above the dam were treated at the same time, 2 gallons of kerosene being used for this purpose. The ensuing drought, however, dried these pools up thoroughly and vitiated the experiment. The total expense of the treatment was $1.70 plus two hours light labor for two men, and the result was immunity from mosquitoes for the household and vicinity.

This is a typical case of those which I had in mind when I expressed last year the opinion that there must be many localities where, by the use of these simple remedies, the mosquito plague may be averted.

It may be well to add that I had the pleasure of receiving, in May last, a note from Dr. Robert H. Lamborn, the donor of the mosquito-essay prizes of two years ago, in which he says, "Your exact observation regarding the treatment of insect-breeding waters with petroleum is most useful and it seems to me to be new." I trust it is understood that no novelty is claimed for the idea, but that I have simply recorded these experiences as showing conclusively that the remedy is not a theoretical but a practical one.

Mr. Smith had known of two recent cases of the use of coal oil for destroying mosquitoes on Long Island, and stated that the results supported Mr. Howard's claims for the method.

Mr. Webster thought that the matter needed more experiment; that there was a prevalent opinion that mosquito larvæ in ponds appropriated a good deal of organic matter that would otherwise become offensive, and by destroying them it was possible to do harm instead of good.

The following paper was next read:

PHYTOMYZA AFFINIS FALL., AS A CAUSE OF DECAY IN CLEMATIS.

By Dr. J. Ritzema Bos, *Wageningen (Netherlands)*.

[Read, in the author's absence, by H. Garman.]

For a few years a disease, formerly unknown, has been observed in various kinds of cultivated Clematis in the gardens of horticulturists in the Netherlands, especially at Boskoop. The affected plants have a diseased spot above the level of the ground; the lower parts are left in perfect health; this can be said in particular of the roots. The parts of the stem lying higher than the diseased spot remain uninjured at first; they dry up, however, because they can not get a sufficient quantity of sap. On the affected spot all parts have become brown and have died; in the first place the cells around certain very narrow mines, in the tissue of the stem. Especially the fasciculi vasorum have become brown in a high degree from the sick spot upward to some height. The sick spot is always recognizable on the outside. In the dead tissues I found, almost as a rule, a fungus of the genus *Pleospora* or a cognate one, and further a few kinds of Anguillulids. The parts of the stem above the affected spot dry up. Some systems of branches consequently die oft in a very short time, while others keep in good health.

In one summer the sickness spread rapidly, so as to cause in a short time the decay of the superterrene parts of many plants, while under the affected spots new buds were shooting forth. The damage caused by this sickness was considerable. Above other varieties *Clematis jackmani* was strongly affected. At various times samples of sick Clematis stems were sent me, but I was not successful in my endeavors to make out the nature of the disease. In the "Zeitschrift fur Pflanzenkrankheiten" of Prof. Sorauer I found mentioned a similar sickness in Clematis stems; and the author of that treatise, Dr. H. Kletahn, at Bremen, gives as his opinion that the illness must be ascribed to the invasion of Anguillulids. He sent me sick Clematis stems for the purpose of a minuter examination of the Anguillulids; but I found not one representative of the genera *Tylenchus*, *Aphelenchus*, or *Heterodera*, known to live generally as parasites in plants; all the Anguillulids I discovered belonged to genera without a spear, and these kinds are indeed sometimes found in decaying tissues, but commonly do not live parasitically in plants.

A remarkable point is the sudden progress of the disease. First the tip of the stem is seen hanging slack, and two or three days after the whole stem above the said sick spot is dead. In 1891, when I repeatedly received sendings of sick Clematis stems, I did not succeed in discovering the cause of the evil, though I could not help supposing that I had to do with the mining of a very small larva. for I discovered in the affected spots mines, which I could hardly consider to be the effect of the work of the nematoid worms I had found; but I did not discover the likeness of a larva or nympha.

In 1892 I was more successful. That year the stems were sent me in June. I then found on the affected spot, in the midst of the stem, a very small larva of a fly; in some already a brownish nympha with a thin, very perishable film. About the middle of June out of these nymphæ came the little fly *Phytomyza affinis* Fall., which consequently must be considered to be the cause of the disease. All the above-mentioned symptoms of sickness, which, at first sight, seemed rather enigmatical, were most satisfactorily explained. I further found that of *Phytomyza affinis* two generations at least are born every year. Therefore, as soon as the disease makes its appearance (in early summer), all decaying stalks must be cut off and burned, lest the evil grow worse by the birth of a new generation.

Mr. Hopkins reported having observed a disease of potatoes due to mines somewhat like those described in this paper.

Mr. Garman spoke of minute mines in the terminal twigs of apple trees, accompanying a sudden blighting of the twigs, which he thought might be due to some related insect.

The following paper was then read:

FARM PRACTICE AND FERTILIZERS AS INSECTICIDES.

By John B. Smith, Sc.D., *New Brunswick, N. J.*

It is safe, I think, to assume that every economic entomologist has been at times woefully disappointed at the outcome of what seemed the most promising experiments. Most of us have learned by sad experience that because a poison, or one used as such, acts well in one instance we can not be at all certain that it will act equally well in another. Many of us have run across insects that seem to eat all our usual insecticides with perfect impunity, or upon whom they act so slowly that they are practically of no effect. I have in mind at present, from my own experience, the Rose chafer, *Macrodactylus subspinosus*, of which many farmers claim, from experiment, that the arsenites do not injure it. I am not quite ready to agree to this, but I am certain that they act so slowly as to be useless.

Frequently we find insects whose life habits are such that we can not

reach them with insecticides, even if we have such as would readily kill them. Of such a nature is the "Boll" or "Corn worm," the larva of *Heliothis armiger*, which in tomatoes lives in the fruit, and in corn lives in the ear; in both cases safe from any application we can make. We have next a series of forms which in their injurious stage live in the soil itself and feed upon the roots of our crops. In cases such as I have mentioned our battery of poison is of little or no avail, because there is no proper opportunity to make use of it. We must adopt other tactics and, if possible, use preventive measures. These may be either positive, as where we cover a tree trunk with a substance mechanically protecting it from injury; or they may be more indirect, as when we change a crop, or plant late, or early, to avoid the period at which injury is done. This latter means of prevention is one which, in my opinion, is worthy of the closest attention and consideration on the part of entomologists. Not the mere planting early or late, but the question of so arranging farm practice as to avoid insect injury to the important crop. Insects have a life history which in the vast majority of cases is practically invariable. There is, usually, a fairly well-marked date of appearance, a tolerably defined period of adult life, and a normal period of development. The first and most important problem to be solved is the exact life history of the injurious species. That done before the matter of insecticides is to be considered at all, the question should be: Can we avoid trouble or injury by modifying our practice without impairing quantity, quality, or price of crop? In many more cases than is usually believed a mere change of time will avoid injury. I do not claim any originality in this suggestion, and need only instance the fact that by a proper attention to the date of sowing, damage from the Hessian fly may be avoided. Rotation of crops, if intelligently practiced, will frequently prevent trouble when insecticides are out of the question. Our fellow-member, Mr. Webster, applied this principle in dealing with the *Diabrotica longicornis*, easily controlling what threatened at one time to become a very serious pest. Trap crops, planted principally to save the more important staple, are often available. For instance a full crop of late squashes may be obtained, free from the borer, *Melittia ceto*, if summer squashes are first planted and the Hubbards and Marrowfats somewhat delayed. The summer squashes will attract the vastly greatest percentage of moths to oviposition, and these may be removed after getting an early crop, filled with the larvæ that would otherwise have attacked the later vines. The proposition to use corn as a trap crop to prevent injury from the Boll worm to cotton has been forcibly urged by Mr. Mally in a recent bulletin from Dr. Riley's office. Methods of cultivation are frequently of use—as for instances in squashes again, where borers attack the vines near the roots. In fertile soil the joints may be covered at intervals and roots will be formed at every such joint sufficient to mature the fruit, even if entirely cut off from the original base of supplies. I have mentioned only a few instances

to illustrate the suggestions made, and make no claim to originality so far as the principles involved are concerned. All have been applied by no means as often as they might have been, but more often by far than the cases cited by me. The importance of fall plowing to destroy forms hibernating in the soil is not even suspected by many of our farmers, but need not be dwelt upon here.

In one other way much may be done to check many forms of destructive insect life—the scientific application of chemical manures, or fertilizers.

In the older States the natural fertility of the soil has long been exhausted, and it is necessary to supply the necessary plant food in some form. The traditional fertilizer is barnyard manure, and to this a very large proportion of the farmers cling as the only true material. Scientific experiments and investigations have shown that the necessary elements of plant food can be as well or better furnished in the shape of inorganic substances, and that they possess in many directions points of superiority over the traditional barnyard manure. In New Jersey the use of these chemical or "artificial" fertilizers or manures is annually increasing, and many of our best truckers, those that actually make farming pay, use nothing else. Merely as an instance of the result it may be recorded that the finest strawberries shown in Chicago this year were from New Jersey and were grown with chemical fertilizers only.

It occurred to me, some years ago, when I noted that farms where these chemicals were used were unusually free from insects, that they might have insecticide properties that could be very usefully employed. Peach orchards were then suffering quite severely from the *Aphis persicæ-niger*, which sapped the roots, especially of small and nursery trees, and my first experiments were directed to the question of the effect of kainit and muriate of potash on plant lice. I found them sufficiently effective to risk recommending them for use, particularly the kainit. Since that time almost every large grower of peaches in the State has dosed his infested trees with kainit, and I have not yet found an instance of failure where it was intelligently applied. How far stupidity can go is shown by a grower who carefully piled little hills of this material round his nursery trees, to make certain it should all get to the roots. He lost almost every one of his trees, though the application, if broadcasted, would have been considered a moderate one only. Of course the potash acted as a stimulant and supplied needed plant food; but even though part of the improvement was explainable in this way in some cases, yet it really made very little difference so long as the primary object, the destruction of the Aphids, is concerned.

In some sections of New Jersey the Corn Web-worm has become somewhat troublesome of late years, and in this season of 1893 is worse than ever before. I have inquired and examined carefully in a number of

cases, and in every case I found that where chemical manures were used injury was insignificant or entirely wanting, while in many other fields in which old methods were employed no stand was obtained after two or even three replantings, and the fields looked excessively ragged and uneven. In one of the bulletins of the Delaware Experiment Station this fact is quite evidently brought out, though not aimed at in the experiment made. Muriate of potash is less effective than kainit, but has very decided insecticide value. Nitrate of soda ranks close to kainit in effectiveness, and is peculiarly valuable as a fertilizer from the rapidity with which it becomes available as plant food, strengthening and stimulating growth as well as destroying insects. I have had opportunities several times this year to note wire-worm injury on farms treated by chemical fertilizers as compared with those on which the usual routine was followed, and the verdict was always and vastly in favor of the chemical manures. No insects can live for any lengthy time in a soil saturated with these fertilizers. and I have tried all forms that have come under my notice. Mr. Fletcher found white hellebore very effective against the cabbage maggot; tried on a maggot that is found in diseased onions, hellebore was far inferior in its action to kainit or nitrate of potash. Truckers using these materials constantly are a unit in claiming practical exemption from cut-worm injury, which is often very severe on planted crops.

I have no desire to present statistics on this subject; these I will reserve for another occasion; my object will be gained by the few citations that have been made and which are examples of those upon which I base my faith that the intelligent use of fertilizers will be of very great aid in eventually freeing us from the injuries of many troublesome species.

This, combined with other intelligent farm practice will, I think, prove the main reliance of the farmer in future. Insecticides will and must continue to be used in some cases; but in my opinion they have been sometimes relied upon to the exclusion of more radical measures.

The strength at which a substance proves effective, and its action on the plant, are matters of importance. Two hundred pounds of nitrate of soda and 600 pounds of kainit are not unusually large applications, and calculating this amount to onion rows I found that to make a thorough application I must use the nitrate at the rate of 5½ ounces to 1 gallon of water, and kainit 1 pound to 1 gallon. I made certain that these were effective insecticide mixtures, and then had one of our leading onion-growers try them over onion rows. They did not injure the plants in the least, either as to leaf or bulb, and as 10-foot rows were treated, injury would have been quickly noticed. Even the tender foliage of rose will stand a solution of kainit at the rate of 8 ounces in 1 gallon.

As a matter of fact the solutions which come into contact with the

insects are often saturated, and much stronger than the mixture given, for if the material is broadcasted or sown in the rows, each drop of water carries with it all that it can dissolve, and as the moisture evaporates the mixture becomes just as strong as it is possible to be, and of course the insecticide effect is intensified.

I will close by simply referring to the fact that the phospates have no insecticide value so far as my experience has gone—not even the odorless phosphate, which has been put upon the market with the usual nostrum circular claiming that it would kill everything.

This paper was discussed by Messrs. Hopkins and Webster.

Mr. Hopkins thought it was a question as to whether the fertilizers really kill insects, or by giving plants increased vigor enable them to outgrow injuries. He had observed in his practice on the farm that the use of stable manure on sod infested with white grubs and wireworms had the effect of producing a good crop of corn when plowed under, while on adjoining land not fertilized the attack of these insects was very destructive.

Mr. Webster had no doubt that fertilizers increased the vigor of plants but thought that Mr. Smith had not demonstrated that they destroyed or drove away the insects.

On motion the association adjourned to meet at 9 o'clock, a. m., August 15.

SECOND SESSION—AUGUST 15, 1893.

The association met in room 24, Science Hall, at 9 o'clock, a. m., President Forbes in the chair.

Mr. Webster moved that Messrs. Edw. H. Thompson, of Tasmania, and R. Allen Wight, of Auckland, New Zealand, be elected foreign members of the association. It was carried.

The secretary stated that he had received in reply to invitations sent to foreign entomologists letters of regret for inability to attend our meeting from the following: H. du Buysson, of France; F. A. Marshall, Cornwall, England; Dr. J. Ritzema Bos, Wageningen, Netherlands; Dr. H. Hollrung, Halle, Germany; Edw. H. Thompson, of Tasmania; R. Allen Wight, Auckland, New Zealand; Dr. C. C. Vinton, of Korea, Asia; Natalis Rondot, Lyons, France; Robert Newstead, Chester, England; Miss Eleanor A. Ormerod, St. Albans, England.

An extract from Miss Ormerod's letter was read containing complimentary words concerning the work of the association and its members.

The following paper was then read:

THE PRESERVATION OF LARVÆ FOR STUDY.

By H. Garman, *Lexington, Ky.*

It is a common practice to drop larvæ of all sorts into alcohol and trust to luck for what happens. My own specimens have been largely preserved in this manner. Frequently they become badly discolored and shrunken, and the internal organs are generally in very bad condition for dissection. Some practice in preparing larvæ for sectioning some years ago led me to adopt the method of killing, and at the same time fixing the tissues of such specimens by a short exposure to hot water. Recently I have employed this for the preservation of larvæ for specimens, and with what seem to me fair results. The procedure employed after a few experiments is this:

Drop the larvæ into water heated to the boiling point (not boiling) and leave for 15 seconds; then when the body wall is somewhat rigid, pick up with the forceps and with fine sharp scissors cut a slit along the under side of the body, then drop into the water again for a few seconds longer. The specimen may now be transferred to 50 per cent alcohol, and in twelve hours to 70 per cent, and twelve hours after to 95 per cent for permanent preservation.

The bodies of such larvæ remain in their natural shape. The colors are pretty well preserved, and the structures are in good condition for either microscopic or macroscopic examination. I find that it will not do to cut slits at intervals along the under side of such larvæ, for the regions between cuts then become discolored. This trouble becomes worse in hot weather.

Everything must be done quickly but thoroughly. Prolonged heating will cause specimens to become discolored by cooking them. Instead of alcohol I have used for some specimens, after killing with hot water, a preservative which gives, as far as I can see now, rather better results. It consists of the following:

Boiling water, 250 cubic centimeters.
Common salt, 3 teaspoonfuls.
Powdered alum, 1 teaspoonful.
Pure carbolic acid, 5 drops. *Filter.*

The paper was discussed by Messrs. Forbes, Hopkins, Osborn, Smith, and Summers.

Mr. Forbes thought the entomologist might get some points on the preservation of the plants injured by insects from the horticulturist, and mentioned the preserved fruits at the World's Fair at Chicago as examples of good work of this sort.

Mr. Summers reported having at one time tested a considerable

number of the fluids used for the preservation of fruits, but had found none of them satisfactory.

Mr. Osborn thought that the aqueous preparations employed were open to the objection that they would freeze.

Mr. Smith had employed a method of killing and preserving larvæ similar to that described in the paper and agreed that alcoholic specimens as ordinarily collected and preserved were often of little use for the study of internal structures.

The following paper was then read:

THE DISTRIBUTION OF COCCIDÆ.

By T. D. A. COCKERELL, *Las Cruces, N. Mex.*

[Read by the secretary in the absence of the author.]

It would be difficult to point to any group of insect pests the ravages of which have been more seriously increased by human interference than the Coccidæ. As a general rule, when one finds Coccids under strictly natural circumstances, they are local in their distribution, and their attacks are confined to one or two species of plants. But now that we continually carry plants from one country to another, we take with them Coccidæ of many kinds, and already some scale-insects are so cosmopolitan by human introduction, that it is very difficult to guess where they originally came from.

It is a matter of common knowledge amongst economic entomologists that the evils thus arising are on the increase; and I would submit to you that the outlook is a very serious one.* Even in the temperate zone you have become familiar with the injuries done by Coccidæ in countries where they are not indigenous; but in the tropics the state of affairs is beyond anything one could easily imagine, without having seen it. Coming to New Mexico from Jamaica, I experienced a kind of surprise at not seeing the leaves of the roadside trees spotted with Diaspinæ and Lecaniinæ, although I knew quite well that such appearances were not to be looked for so far north. In Jamaica, if instructing an inexperienced person to collect Coccidæ, it would almost be sufficient to say "gather leaves of various trees that grow about the town."

The luxuriance of tropical vegetation is such that the harm done by Coccidæ is not so great as one might expect from their abundance; but still, their presence is often the occasion of annoyance and injury to

* I here assume that anything which decreases the food supply of the human race is disadvantageous. This is not the place to discuss those artificial conditions, whereby abundance is made a cause of scarcity, and the wealth of some depends upon the want of others.

growers of field and garden crops. On the whole I see no reason to doubt that Coccidæ do more injury in the tropics than elsewhere, although their ravages have not very frequently been recorded; and probably there is no tropical country whose Coccid fauna is not at the present time being increased by introductions.

Having said so much, I wish to call your attention to a few facts which have come under my own observation, hoping to illustrate thereby the more important phases of the subject.

The number and variety of neotropical Coccidæ have not been sufficiently realized in the past, owing to the fragmentary nature of our information concerning them. At the present time those of the West Indies are better known than the species inhabiting the mainland, but even here the records are exceedingly imperfect. Jamaica has 61 recorded species, but Cuba has less than half a dozen, and I can not discover a single record from Haiti. The Coccidæ of the Bahamas are almost entirely unknown, although the Caicos and Turks islands have each produced an interesting endemic form. In the Lesser Antilles, thanks to Mr. C. A. Barber, Antigua has 16 records; but of the other islands only one has as many as half a dozen, the figures being Barbados, 7 (only 5 actually published); Montserrat, 4; Grenada, 3 (records not yet published); and Nevis, St. Kitts, and Dominica 1 each. Trinidad has 14 species (some not fully identified), but owing to the exertions of Mr. F. W. Urich, I shall shortly be able to add considerably to this figure. The Mexican list stands at the absurdly low figure of 26, which includes 12 found by the present writer recently while traveling through that country. It will be understood how insufficient are the published records when I mention that not one of the species I found was previously known from Mexico, so far as I have been able to ascertain. The list from British Guiana exceeds 20, but very few species are known from other parts of South America. For Brazil I find mentioned about half a dozen, for Chile 4, for Ecuador 1, and so forth.

Yet these beginnings of knowledge already indicate some interesting facts in geographical distribution.

Aspidiotus articulatus, Morg., is known from Demerara, Trinidad (St. Ann's, on *Pandanus*, coll. by F. W. Urich), Barbados, Nevis, Jamaica, and Mexico (Vera Cruz). It has not been detected in Antigua, where it must be absent or rare, else Mr. Barber would surely have found it.

Aspidiotus personatus, Comst., is known from Demerara, Barbados, Cuba, and Jamaica. I did not find it at Vera Cruz; and what is more interesting, Mr. Urich, after some search, has been unable to detect it in Trinidad.

These two species, where they occur, infest many kinds of cultivated trees and shrubs, and are quite noticeable. Up to the present time, neither has been detected in the United States, although if introduced they might probably manage to exist in the extreme South. Both prob-

ably are spreading through human means. *A. articulatus* probably originated in South America; but *A. personatus* is more likely a native of the Greater Antilles, its absence in Trinidad favoring this supposition.

Aspidiotus ficus, Riley Ms., Ashm., abounds in Jamaica, and is also known from Cuba and Florida. It is likewise common at Vera Cruz, Mexico. Probably it is a native of the Greater Antilles, but possibly of Mexico; it has apparently been taken to Japan, whence it was brought to California, according to Mr. Craw. It does not appear to occur yet in the Lesser Antilles, Trinidad, or Demerara. It is against its being of Mexican origin that I could not find it on oranges sold in that country, except at Vera Cruz, which is a most likely place for any scale to be imported. Mr. H. Tryon reports it from Australia.

This, like the two before mentioned, feeds on many plants. It seems probable that unless means are taken to prevent their introduction into various countries on plants, all three are destined to become universal in the tropics. Any one who has seen them in Kingston, Jamaica, where they all abound in the same locality, will appreciate the undesirability of this, from an agricultural and horticultural point of view.

Aspidiotus aurantii, Mask., has a very curious distribution: Australia, Tahiti, California, New Zealand, South Europe, and the West Indies. Who shall say where it originally came from? But the curious thing about it is, that in Jamaica it is not found on Citrus trees, but principally on lignum-vitæ (*Guaiacum*)—occasionally also on Cycas* (at King's House) and Areca. Its place on the Citrus trees in Jamaica is occupied by *A. articulatus*.

Apidiotus punicæ, Ckll., presents another instance of difference of food plant according to locality. In Jamaica it is found principally on pomegranate, never, so far as I know, on cocoanut; but in Dominica Mr. Barber found it infesting the cocoanut palm, just in the way that *Aulacaspis boisduvalii* infests it in Jamaica.

A fact that should not be lost sight of is, that tropical Coccidæ may be taken from one side of the world to the other, via hothouses in temperate climates. It is wonderful what a lot of interesting forms have turned up in hothouses in Europe. Signoret mentions no less than 48 found in such situations; and Douglas and Newstead have recorded several from greenhouses in England, the most recent addition being *Pseudinglisia rodriguezia*, Newst., which appears to be referable to my genus *Conchaspis*. Some time ago, I wrote to Kew, urging that an entomologist should be appointed to inspect the plants distributed by that institution to all parts of the world. Mr. D. Morris kindly replied in great detail, stating that at Kew they took all possible care, and that probably private importers and exporters were in most cases responsible for the wide distribution of certain Coccidæ. Be this as it may, it is clear that the scale insects manage to travel, and it is difficult to see how Kew or any large dealer in exotic plants can avoid transmitting

* Mr. Cockerell subsequently wrote us that this is not *A. aurantii* but probably *A. dictyospermi* Morg.—*Eds.*

pests unless the plants are under the strict supervision of an entomologist. This leads one to think of quarantine regulations which have not yet been dreamed of in England; and so far as present methods go, no doubt Kew is altogether superior to the average of private firms, as Mr. Morris states. The consequence of this state of affairs is, that one never knows what will turn up in a given locality. *Chionaspis minor*, Mask., described from New Zealand, now proves to be common in the West Indies. *Dactylopius calceolariæ*, Mask., from New Zealand and Fiji, is discovered in Jamaica. *Lecanium mangiferæ*, Green, from Ceylon, is detected in Jamaica and Demerara. A Ceroplastes from Antigua, which I believe to be the same species as *C. cassiæ*, Chav., of Brazil, does not appear to differ from *C. dugesii*. Licht. MS., Twns. (of which I have specimens), from Mexico, and these again seem identical with the Indian *C. ceriferus*, Anders. Mr. Maskell pointed out this latter fact to me, and he has been so good as to forward Indian specimens of *C. ceriferus*, which seem to bear out his opinion as to the identity. I have all three now before me, but Mr. Maskell had only compared the Antigua form with *C. ceriferus*.

Such instances become more numerous as fresh information comes to hand. Thus *Asterolecanium* (*vel Planchonia*) *pustulans*, Ckll., known from Demerara, the West Indies, and Florida, was lately detected by myself at Vera Cruz, Mexico; and Mr. Maskell writes me that he knows it from Brazil and the Sandwich Islands. When I promised this paper, I thought of preparing something more elaborate than these few notes; but the distractions attendant on a change of residence, and the temporary detention of my books in Mexico City, through the blundering of a transfer company, have made it impossible to adequately gather together the statistics. Nor have I tried to discuss the distribution of Coccidæ within the United States, as I have nothing fresh of importance to contribute, and among those present are some doubtless much more competent to speak on this subject than myself. Yet the principles are the same throughout, and the evident indications are that we should endeavor to increase the knowledge of coccid distribution by all possible means, and so far as possible to prevent their importation into fresh countries. If my view is correct, now is the time to insist on the necessary precautions, as in fifty or a hundred years it will be altogether too late.

In conclusion I will give a list of the coccids I found this year in the Marine Gardens, Kingston, Jamaica. This locality is in the midst of the town, and it will afford an illustration of the coccid fauna of the island, as now found on cultivated plants. It may be seen at a glance that nearly all the species have been found in distant localities, and it may well be doubted if the scale insects as a whole belong any more to the original fauna of Jamaica than the plants on which they are found do to the flora.

Coccidæ of the Marine Gardens, Kingston, Jamaica, April, 1893.

Species.	Plants infested.	Distribution elsewhere.
1. *Dactylopius longifilis*, Comst.	On a palm; and 1 juv. on upper side of leaf of star-apple.	District of Columbia (under glass).
2. *Dactylopius virgatus*, Ckll.	Several juv. on leaf of coconut.	(Endemic so far as known.)
3. *Asterolecanium pustulans*, Ckll.	On pink oleander; very abundant and injurious.	Montserrat, Demerara, Florida, Mexico, Brazil, Sandwich Islands.
4. *Lecanium oleæ*, Bern.	On Terminalia; on pink oleander, and many on twigs of star-apple, attended by ants.	Antigua, Mexico, California, Florida, South Carolina France, Australia, New Zealand.
5. *Lecanium terminaliæ*, Ckll.	On Terminalia	Mexico.
6. *Lecanium hesperidum*, L.	One on a palm; found by my wife.	Mexico, Sandwich Islands, South Africa, Europe, Georgia, Utah, California, Florida, New York, District of Columbia, Ohio.
7. *Lecanium hemisphæricum*, Targ.	On an orchid; on a palm	Trinidad, Antigua, Montserrat, New Zealand, Pennsylvania, California, Australia, Europe (under glass).
8. *Ceroplastes floridensis*, Comst.	On oleander; on upper side of leaves of star-apple.	Florida, Louisiana, Barbados (on leaf, apparently *Chrysophyllum*).
9. *Aspidiotus articulatus*. Morg.	On oleander, with newly hatched larvæ, which are orange; on Citrus; on upper side of leaves of star-apple.	Nevis, Barbados, Trinidad, Demerara, Mexico.
10. *Aspidiotus ficus*, Riley MS., Ashm.	On upper side of leaves of pink oleander; on under side of leaves of rose; on Citrus; many on upper side of leaves of an orchid.	Cuba, Florida, Mexico, Japan, Kew (under glass), Australia.
11. *Aspidiotus sacchari*, Ckll	On sugar-cane	(Endemic so far as known.)
12. *Aspidiotus personatus*, Comst.	On a palm	Barbados, Cuba, Demerara.
13. *Diaspis lanatus*, Ckll	On oleander	Antigua.
14 *Aulacaspis boisduvalii*. Sign.	On coconut, ♀ pale lemon yellow.	Barbados, Trinidad (Urich), Europe (under glass).
15. *Pseudoparlatoria ostreata*, Ckll.	On Acalypha	(Endemic so far as known.)
16. *Chionaspis minor*, Mask	On a palm	Trinidad, Antigua, New Zealand.
17. *Ischnaspis filiformis*, Dougl.	On a palm	Trinidad, Antigua, Grenada, Demerara, District of Columbia (under glass), London (under glass).
18. *Pinnaspis pandani*, Comst.	On coconut	Trinidad, Massachusetts (under glass).

Thus, of 18 species, all but three are known outside of Jamaica (and it is very doubtful if these are confined to the island, although not yet found elsewhere), while eleven have been detected outside of the neotropical region.

The following paper was then read:

NOTE AND RECORD KEEPING FOR THE ECONOMIC ENTOMOLOGIST.

By A. D. Hopkins, *Morgantown, W. Va.*

There is nothing of greater importance in the work of an economic entomologist than a well-organized system of keeping notes, records, and references. Especially is it important as a primary feature of the office and laboratory organization of the Experiment Station entomologist.

One of the objects of the law establishing the Agricultural Experiment Stations was to "stimulate original research and experiments

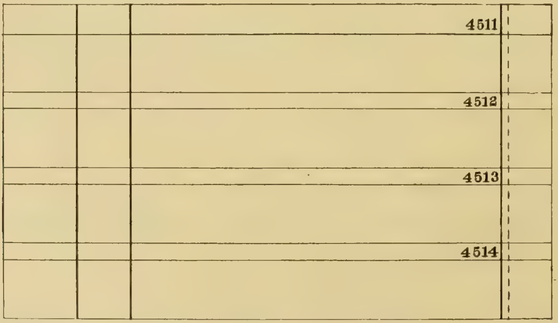
bearing directly upon the agricultural interests of the United States." Therefore it is necessary, in the exercise of our complicated duties as station entomologists, that we confine our attention especially to the discovery of new facts relating to the insects of the State or Territory in which we are located, and that we not only take many notes and make numerous records and references, but we should keep the valuable material thus gained according to some well-defined plan, in order that any portion or all of such information may be readily accessible in case it should be required for immediate publication or answer to inquiry.

In laying the foundation for entomological work at the West Virginia Experiment Station I have given special attention to this feature of the organization, and have worked out and adopted a system which has proved to be well adapted to the requirements of the character of the work in which I am engaged.

The system consists of an accessions catalogue and a species catalogue. These two catalogues contain or refer to all available information on identified and undetermined material in the collections, to all investigations, experiments, and observations, and to certain desirable literature relating to the identified species.

THE ACCESSIONS CATALOGUE.

This consists of a series of note pads or books, each containing 100 numbered spaces, in which entries are made referring to all numbered accessions to the collections, insectary or laboratory, also to numbered experiments, etc. The leaves of this pad are divided into spaces as shown in the following diagram, which is one-half the size of the pads I have used:



The spaces in the central portion are for localities, dates, names of accessions, numbers, and notes as indicated. The perforated transverse margin at the right is for detachable number and label slips, while the first transverse space at the left is for check-list numbers, names of species, and authority for identifications. The next space to the left is for name of host plant or insect.

The check lists referred to by check-list numbers are indicated by the first letter of the order represented placed immediately above the number.

The spaces on the note sheets are numbered by a consecutive numbering machine, and may continue from one to as high a number as desired. During collecting tours and other outdoor investigations, one of these pads, held in a case provided for the purpose, is carried in the pocket the same as an ordinary note-book. Entries are made in the numbered spaces at the time specimens are collected, and a corresponding number is placed with and remains with every specimen or set of specimens, experiment, etc., referred to. When entries have been made in all of the numbered spaces, the pad is taken from the case, the edges trimmed, and all surplus attachments removed. Then it is placed in the accessions catalogue file, and, as other pads are subsequently filled, they are filed with the first in consecutive order; thus forming from the first, and at any time after, a complete catalogue of all accessions.

THE SPECIES CATALOGUE.

This contains a complete list of the names of all the determined species in the collections, together with references to all notes, records, experiments, and investigations, and all other available information relating to each. The names, check-list numbers, accessions catalogue numbers, and other references are entered on cards or slips of uniform size ($6\frac{5}{8}$ by $4\frac{1}{4}$ inches), and the cards are arranged in systematic order according to the standard check list and synopsis of the order represented, and are filed in cases the same as the cards of an ordinary card index.

Two sets of cards are used for this catalogue. One called the species cards, and the other the record cards. The species cards have two spaces at the top, each five-sixteenths of an inch wide. The first space is for the check-list number or generic name. The second space is for the generic and specific name only, and the space below is for the synonyms, references to descriptions, classifications, corrections, etc. In no case should an entry be made on this card unless the species has been identified at least generically. If an identified species has a check-list number, the number alone will be sufficient to keep the card in its proper position in the catalogue file, but in case there is no check-list number for the species, the name of the order should be entered at the left in the upper space, the genus in the center, and the family at the right. This will facilitate keeping the species cards in their relative positions.

The record cards differ from the species cards in having but one space at the top. This space is for the check-list number, or if there is no check list in the order represented, the full name of the species is entered. The space below the line is for accessions, catalogue num-

bers, references to notes, experiment, in fact, all available information pertaining to the species represented by the check-list number.

The record cards are placed in the file with and succeeding the species cards, bearing a corresponding check list number or name. If the space on the first record card is not sufficient to accommodate all necessary entries. another is taken, and so on, using as many cards as may be required for all references or for full notes as desired.

All experiments, special investigations, and observations must have reference to some species of insect; therefore, in case it is found necessary to make a note or record having reference to a known species, of which specimens are not desired or can not be taken, instead of making the entry in the accessions catalogue, regulation record cards are used for the purpose, and the notes are entered under the name of the species, and the cards are placed in their proper positions in the species-catalogue file. In fact, if desired, the species catalogue may contain copies of all notes, records, descriptions, drawings, and all other material necessary for a full treatise or report on a species; or, in other words, any number of the record cards required for notes referring to a single species may succeed the species cards, provided they all bear the check-list number or name and have letters or Roman numbers in the upper right-hand corner to indicate their relative position in the series.

In order to explain a method of cross references used in this system, we will suppose that a set of pinned specimens, accompanied by their respective accessions catalogue numbers, are sent to a specialist for determination, and in due time we receive the list of names according to the accessions numbers. If the specimens belong to the order Coleoptera we take Henshaw's list and enter each of the accessions numbers immediately to the right of the corresponding specific name in the check list. Then we take the accessions catalogue and enter the proper check-list numbers in the spaces at the left of the notes bearing corresponding numbers to those of the determined species. The names of the species and their check-list numbers are then entered on the species card and references or full notes are copied on the record cards. After all necessary entries and cross references are made we place two labels on the pins bearing the determined example, or on duplicates having the same number. The first label bears the accession number and the name of the collector; the second label bears the check-list number, the name of the insect, and name of the person responsible for the determination. The specimens are then placed in their relative positions in the systematic reference and duplicate collections. As subsequent material belonging to a determined species is determined or added to the collection, the proper check-list number is entered in the accessions catalogue, and the pinned specimens are placed with the labeled specimens in the duplicate collection. The duplicate alcoholic, biologic, and economic material is placed in envelopes or packages which are marked with the proper check-list number and the name of host plant or insect.

ADVANTAGES OF THE SYSTEM.

Some advantages of a system of this kind may be mentioned as follows:

The check lists and monographs of the different orders are indexes to all determined material in the collections, and to all notes, records, and important literature pertaining thereto. They also show at once the number of species represented in the collection in any given order, family, or genus.

The accessions catalogue contains all original entries referring to all the determined as well as undetermined material.

The species catalogue may not only be an authentic catalogue of all the determined species in the collection, but, immediately succeeding the the name of each species, may contain reference to, or full notes of, all original observations, experiments, etc., together with references to available or desirable literature.

If at any time it is found that a species has been incorrectly determined, we have only to make the correction on the species card and change the check-list number or name on the record card and transfer the set to their proper places, leaving a card in the old position bearing a reference to the correction.

By means of the accessions numbers, check-list numbers and cross references all available information regarding any determined or undetermined species or specimens in the collection may be conveniently and quickly traced, either from the specimens to the notes or from notes to specimens.

In tracing from the specimens to the records the accession number on the specimen refers to the note in the accessions catalogue, where locality, date, food plant, and all other observations noted at the time the specimens were taken, together with subsequent notes and references, are found. If the specimen refers to an identified species the check-list number or name is found in the space at the left of the note; if a check-list number we are at once referred to the species catalogue, where references to records, etc., are found. If there is no check list for the order represented, and we find instead of the check-list number the name of the species, we turn to the index of the synopsis or monograph of the order represented to find the family and genus to which it belongs, after which we can easily find the desired information in the species catalogue by means of family and genus labels on projecting cards in the file.

In tracing from the note to the specimen, if relating to an identified species, we have only to find its family and generic position in the collection by reference to the check list or synopsis as we have just indicated. If referring to an undetermined species the specimens are found by means of the food-substance label under which the numbered specimens are arranged in consecutive order.

If we receive a bulletin or some late literature on the habits of certain insects represented in our collection, and we desire to know what our observations have been on the subject, we can quickly look it up, and at the same time enter a reference on the record or species card, to the literature in question.

On the other hand, if information is desired regarding a specimen among the undetermined material that we suspect belongs to an identified species, for instance, a small piece of bark or wood showing the larval mines of a bark beetle or wood borer, the accession number is, say, 4000. We turn to the accessions catalogue and find that the specimen is the larval mine of accession number 4001, which was a larva that had been reared to adult. We find that the adult had been determined and the check-list number entered in the space at the left of the note; thus, from any determined or undetermined fragment in the collections having reference to a determined species all available information regarding the species may be traced.

In conclusion, I desire to say that I do not wish it understood that I claim all the principles of this system of taking and keeping notes and records as original. No doubt some such system is in use by many of you here, differing mainly in being adjusted to suit your convenience and the requirements of your respective duties. As adjusted to suit the convenience and requirements of my own work it does contain some original features, which, I trust, may be of interest to some of you who are engaged with me in exploring the broad field of hidden facts open to the economic entomologist; facts that must be discovered and recorded in order to make our work more efficient.

Every note and record of original observations truthfully and systematically recorded will add materially to the advancement of the science. What may seem at the time trivial may, if recorded, lead to important discoveries, or prove to be the connecting link in the chain of facts making up the knowledge of the complicated life history and habits of some serious pest of the farm or forest.

Is it not important, therefore, in our life work that we not only make frequent entries in our notebooks, but that we keep our records of original observations and facts determined according to some well-defined plan that will enable us at any time to quickly trace up, for publication or other purpose all the facts we may have on a given species or subject, or in order that our successors may profit in finding our unpublished notes readily available?

In discussing this paper Mr. Smith said that he did not approve of the use of check-list numbers alone, and thought the name of an insect, as far as known, should always be given.

Mr. Osborn thought check lists should not be used. They are not available for all orders of insects. The names, he thought, should be written out in notes when possible.

Mr. Webster thought Mr. Hopkins' method too complicated. He used a notebook for his records, and gave a brief description of his method of entering notes as follows:

In my own practice I ignore check-list numbers and use the name of a species, combining in one book the accessions catalogue and the notebook, my numbers running consecutively year after year, and through volume after volume. I use square 12 mo. blank books, the first line containing the number, host, and species, thus:

825	Wheat. Isosoma tritici.
	June 29. Larvæ in straw, etc.

All specimens connected with any note are numbered the same as the note. If there are parasites their names follow the species on the upper line. When my book is filled I make a plant and an insect index referring to number of note and page of book, distinguishing these by black and red inks.

The following paper was then read:

ILLUSTRATIONS FOR THE ECONOMIC ENTOMOLOGIST.

By H. Garman, *Lexington, Ky.*

The important reason for illustrating writings is, I take it, to make the meaning plainer; to help to the recognition of objects not easily or satisfactorily described. A few movements of the pencil in drawing often make clear what could not be adequately described in a page of text, and the simple sketch so made will, with most of us, leave a more lasting impression on the mind. We do not often forget what we have seen. We more often forget things read about. The usefulness of figures for this purpose is abundantly attested by the increasing demand for them in all sorts of commercial work—in advertising, in journalism, in literary magazines, and in many departments of scientific work. It is probable that more new illustrations are now produced in a month than were issued in any year previous to 1870.

The great majority of such illustrations are intended to convey information and to save time in description. Finish and technique in drawing are consequently matters of secondary importance. They answer their purpose with the public when accurate in a general way and as far as possible self-explaining.

The public of the economic entomologist is not very different from the general public. It will not scrutinize an illustration very closely for details. It wants clearness first, finish next. But the position of the economic entomologist with reference to his public and to his subject is somewhat peculiar. If he published illustrations only for the use of

the agriculturist, figures accurate as to form and markings in a general way would be sufficient. Detailed drawing would be unnecessary. In the present state of applied entomology a considerable part of his work is in the nature of original investigation in the pure science of entomology. To him has been left often the work of describing and illustrating nice points of structure, of habit, of distribution, and the like, necessary to an understanding of the practical problems before him, and at the same time of the highest scientific value. If he is weak he may let this pure science of his work overshadow the more immediately practical science, and by publishing without discrimination technical illustrations and descriptions, endanger his success with the agriculturist. The farmer cares little about the number of denticles on the mandible of an insect, but he ought to know whether a given insect gnaws vegetation or punctures it. He does not care whether the wings of an insect are frenate or jugate, but, it may be, would like to know whether the owner flies readily from one field to another. He does not care at all about the structure of the ommatidium of a facet eye, but often wants to know very much whether an insect is black or brown, is banded or not, is one-fourth inch, or one-half inch long, and these are facts which the economic entomologist must keep before him in making illustrations for the agriculturist. He must produce figures that will be recognizable as likenesses; he must make accurate figures, for his own credit, at least, and if he can add to these two necessary qualities excellence of drawing, he may feel well satisfied with his work. Figures, showing only technical details of structure, are to be published as far as possible in the technical entomological journals, no matter how important to applied entomology such illustrations may be assumed to be. Attempts to combine what is intended solely for the entomologist with what is published for the agriculturist, sometimes work to the disadvantage of the latter. The fact that the entomologist does not suffer so much from this combination may account for the seeming failure of some good workers to recognize this defect in their published work. Reports on economic entomology have been published that are largely beyond the comprehension of the average farmer. The authors wrote, unintentionally I think, for the economic entomologist and not for the farmer.

Figures should be made of a size to be conveniently printed with text of the ordinary octavo page width. When possible all the stages of an insect should be represented, and when this is not possible from lack of time or material, let that stage be chosen which does the injury, if an injurious species, the one most likely to be encountered by the farmer. Besides such figures, others showing the nature of the injury done, or of the habitations of the insect are very desirable. In other words, show in illustrations what the farmer can observe and verify. He will never dissect out the mouth-parts of a flea-beetle.

A dorsal view of an insect is the one calculated to show most that is

characteristic, and when only one view can be made, is generally to be preferred. The legs can generally be shown to best advantage in the conventional position, that is, drawn out and symmetrically placed at the sides of the body. The wings of Diptera, Hymenoptera, Lepidoptera, Odonata, and the like, should generally be represented drawn out and placed symmetrically for the reason that they show in this position characteristics of venation, and markings are more easily drawn, and more readily compared with specimens. It requires something of the artist to show an insect in natural positions, of rapid flight for example, and most entomologists can not afford to attempt it. If a special draftsman is at one's elbow, the case is somewhat different. Awkward attempts, however, are worse than none, and it is not every entomological draftsman who is competent to do such illustrative work as that in "Sharp Eyes," by Gibson.

But supposing the objects to have been judiciously selected, how shall the drawings be reproduced? Must it be by cheap process, by wood engraving, by lithography, or by etching?

Etching, by leaving all the hand work to the draftsman, is theoretically a good method of making entomological illustrations. If the entomologist makes his drawing on the plate skillfully there is no chance for alteration afterwards, except as the subsequent mechanical work of biting in, and printing, may be poorly done. The special method of drawing called for, however, will deter most of us from attempting it. With only about thirty years for effective work at one's disposal it does not seem wise to expend energy in acquiring unusual methods, which may any day be superseded by something better and cheaper. The further fact that etchings can not be printed with ordinary type is an objection which ought always to prevent their use by the economic entomologist.

Lithography has furnished some excellent results to the entomologist. The French have shown themselves especially proficient in this method of making figures. Some of their work appears to me to be unrivalled for pure beauty and delicacy of execution. In the United States we have, with some very inferior work in this line, some very good examples of the lithographer's skill, as in Edwards's Butterflies of North America. But lithography costs too much for use by the economic entomologist. We can not afford to pay $200 or more for small editions of plates. We can't afford to use, except on special occasions, an illustration that can not be duplicated in the future. We do not want an illustration that can not be printed by the ordinary printer on the ordinary press. We want both illustration and text printed at one and the same time. The lithograph requires a special press, it can not be used again and again. And another objection to it is that it must be printed in plates, whereas it is often desirable to separate groups of plate figures and distribute them in text. It would seem that for the economic entomologist, the lithograph must always be an expensive luxury.

Wood engraving is better. It is not open to any of the objections against etching and lithography. It can be easily and cheaply duplicated. It yields a clear, neat figure when printed on only fair paper. It can be used in plates, or scattered in text. But it has one serious defect, namely, that the original drawing must be reproduced on the block and engraved by one who may not render it exactly. This is not so serious an objection when the engraving is in good hands, and especially when it is done by one who is accustomed to engrave for scientific men. But the best of engravers are liable to misinterpret some detail of a drawing, making the result far from satisfactory. At the same time it must be said that of our published figures woodcuts are the very best. The figures published by Prof. Riley in his Missouri reports are still among the best we have. We have none that have been so universally accepted and used in writings of all sorts. Even in so excellent a work as the Century Dictionary we find copies of some of these figures holding their own in quality with anything appearing there. It may be true that their success is not entirely due to the fact that they are woodcuts, but it is equally true that they would never have become so well known and universally used if they had been produced by any other method.

If the entomologist could transfer his drawing to the block and engrave it there, he might stop with woodcuts and bide his time until something better was produced. But life is too short. He can not afford to spend time learning to engrave. He knows that the man who attempts to make his own shoes and hat will get behind his fellows.

But the plain truth is that, with its disadvantages, wood engraving remains our most satisfactory method of making illustrations.

Cheap process* figures have of late all but displaced wood cuts in current literature, and appear likely to occupy most of the field. Their cheapness and the quickness with which they can be produced are their strong points as compared with wood engravings. For the newspaper and other transient literature they are appropriate and useful. For permanent literature, and especially scientific writings, it may be questioned if they have yet proved their right to be. They are often hard on the eyes, parts being too obscure for ready interpretation. The shaded figures sometimes impress one as if they were a little out of focus.

A good clean outline, almost or quite as good as a woodcut outline, can be obtained by some of these processes, if the original drawing is well made with a pen and good black India ink. Some of the figures in Dr. W. K. Brooks's Handbook of Invertebrate Anatomy are examples of good work of this kind, though the drawings are sometimes faulty,

*I do not include under this head heliotypy and other processes yielding blocks costing more than 20 cents per square inch of printing surface. Some of these give good results, but are too costly for general use.

by the Boston Heliotype and Printing Company. The plates in Hyatt and Arms' little book on insects (forming one of the series entitled "Guides for Science Teaching," published by D. C. Heath & Co.), while not always handsome, are clear and bold, never leaving one in doubt as to what the draftsman intended.

But the economic entomologist often requires something more than outlines and I have yet to learn of the cheap process which gives him the result in shaded figures showing patterns of coloration, sculpturing, and the like, that he should get. Certainly we have nothing in this line as good as first-rate woodcuts.

The process figures of our station bulletins do not average high. Some are decidedly bad. It is sometimes, of course, the result of poor drawing and printing, but more often, I think, of imperfections in the methods of reproducing them. It is sometimes evident that very good drawing has resulted in extremely bad printed figures.

Some of our best results in process figures are to be seen in the reports of the Agricultural Department at Washington and in INSECT LIFE. For mere beauty some of this work surpasses most wood cuts, yet it can not be considered entirely satisfactory, for reasons suggested above.

This much can be said for the cheap process figures, that they give promise of something better in the near future. It is very probable that within the next twenty years the processes will be so far perfected that they will yield as good results in every respect as the wood engraver now gives us. If it were not for the hopeful outlook in this direction the entomologist might well return at once to wood engraving. What I wish more especially to urge here is that we can not afford to rest satisfied with present achievement. The block-maker is sometimes inclined to give us work that might pass for transient literature, but should not be accepted for publication by a naturalist. By existing methods he can often do much better than he does. The naturalist should not be satisfied with careless work. It falls upon him to urge, by every means in his power, the improvement in process figures. His drawings should be made with extreme care, and, if necessary, adapted to the process employed in reproducing them. One very serious difficulty in the way of getting the most from our cheap processes is the unwillingness of the average draftsman to accommodate his drawing to the requirements of the process. When urged to make his drawings larger and his contrasts sharper, he sometimes replies that the block-maker should follow him, not he the block-maker. In other words, the inclinations and convenience of the artist should be considered before those of the mere maker of plates. No doubt the work of the draftsman is of prime importance whatever the process by which his work is rendered. But the fact remains that he can not get the best final results if he does not sometimes put aside some of his notions about high art and draw for the process. Looking at it from

the standpoint of the naturalist, it is hard to see wherein the artist bemeans himself or his art by working with sole reference to the final and permanent published results of his work.

This brings me to the matter of giving credit for drawings used in writings on economic entomology, with which I shall close. A good draftsman ought always to receive credit for his work. If he is something of an entomologist, as he should be in order to do some kinds of work, his initials may properly be placed by the side of his figures on the block. It is frequently the case, however, that drawings made by the entomological draftsman are more the work of the entomologist than of the one who used the pencil. Most of those who have had drawings of small insects or their parts made will probably agree that it is often harder work to get satisfactory results than it would be to make the drawings without help. In such case it appears fair to state, either in preface or elsewhere, that the drawings were made under the direction of the entomologist. Where the drawings are made by the entomologist alone he is of course entitled to place his initials by them, or indicate in any other way commending itself to his taste that they are from his pencil. When he copies the figure produced by a fellow entomologist the result should, in scientific writings at least, be credited as "after" the original figure. In station bulletins and elsewhere of late one sees well-known figures printed from electrotypes made directly from the original woodcuts, or else from electrotypes of these, credited in this manner. It would seem well to credit all such prints as "from" the author of the figure, not "after" him, using the latter term to indicate only such figures as have been redrawn.

In the discussion following the reading of this paper Mr. Osborn stated that photography seemed to him to promise good results in the way of furnishing figures, but that as at present used first-rate photographs were a necessity. The results obtained at present were, he believed, often bad largely because of careless printing or the use of poor paper.

Mr. Weed thought fresh specimens should always be selected for drawing, and considered photography more useful for making illustrations showing the work of insects than for figures of the insects themselves.

Mr. Smith considered line drawings superior to all others for process figures, and showed some excellent prints in several kinds of paper which he believed demonstrated that all the detail necessary in an illustration could be obtained by photography. To reproduce well the contrasts of a photograph must be sharp.

Mr. Hopkins stated that it seemed to him desirable to place a natural size figure of an insect by the side of the enlarged figure, as farmers

did not understand the meaning of the hair lines commonly used, and were often misled as to the real size of the insect pests.

Mr. Gillette agreed with Mr. Hopkins, and added that in his opinion it was often better to illustrate the work of a pest instead of giving figures of the latter.

Mr. Forbes inquired as to the printing of half-tone blocks on ordinary book paper. Messrs. Howard and Garman thought the cost of half-tone figures an objection for general use.

Mr. Smith replied that plates could be made for about $7 apiece. Messrs. Howard and Galloway stated that they cost the Agricultural Department at Washington from $10 to $20.

Mr. Gillette wished to know if there was any one in the country who could be trusted to make drawings of insects which were sent to him for that purpose. Mr. Forbes considered it very difficult in such cases to get results satisfactory to the entomologist.

Mr. Howard did not think the photographs shown by Mr. Smith demonstrated that better figures would be produced from them than were obtained from woodcuts, or even process drawings.

The following paper was then read:

THE ARSENITES AND ARSENICAL MIXTURES AS INSECTICIDES.

C. P. Gillette, *Fort Collins, Colo.*

The object in preparing the present paper has been to get together in a short article as much as possible of the important knowledge at our command concerning the arsenites as insecticides.

The article does not pretend to be an exhaustive one, and we have not been able to examine the extensive literature upon the subject as thoroughly as was desired, so it is probable that important matters have been overlooked and perhaps erroneous conclusions arrived at. It is hoped that such additions and corrections as those present are able to offer will be freely made during the discussion that will follow.

The value to this country of arsenical poisons for the protection of crops against insect injuries can hardly be overestimated. Arsenic in its various combinations is the great panacea for all the evils inflicted upon man by leaf-eating vermin. Through its use the value of our annual food supply is increased by many millions of dollars.

EARLY USE OF THE ARSENITES.

It is probable that we can never know with certainty who first used arsenic in any of its combinations for the destruction of insects, and it matters little that we can not.

A Mr. Bryan Markham, of Michigan, claims to have used Paris green for the destruction of the Colorado Potato-beetle as early as 1867, but

is unable to prove the date. Dr. C.V. Riley,* in Missouri, and Mr. George Liddel,† of Fairplay, Wis., both used Paris green for the destruction of the potato-beetle in 1868.

White arsenic seems first to have been used mostly in soluble form. In the report of the Entomologist (Report of the U. S. Department of Agriculture for 1884, p. 327) Dr. Riley speaks of arsenic being used as an insecticide in 1871, and we find no account of its use prior to that date.

London purple, so far as we can learn, was first put to practical use by Dr. Riley for the destruction of the Cotton Worm in 1878.

COMPOSITIONS AND PROPERTIES OF THE ARSENITES.

Arsenious acid (or arsenious oxide), As_2O_3, is the active principle in the arsenical combinations used as insecticides. Commercial white arsenic is practically pure arsenious acid. It is entirely soluble in ten parts of boiling or one hundred parts of cold water and has a specific gravity of 3.7. It is cheaper than either London purple or Paris green, and as it contains the active principle (As_2O_3) in larger proportion than either of these substances, it would, at first, seem reasonable that it should be most used as an insecticide, but it is not, and for several reasons probably never will be. Its white color is objectionable, rendering it liable to be mistaken for materials used in cookery. The powder mixes with much difficulty with water, and when mixed settles quickly on account of its high specific gravity.‡ When in solution it is so extremely injurious to foliage that it is not safe to use for the destruction of insects.

It is readily mixed, however, in a small amount of soapy or lime water and, on account of being least§ injurious of the arsenites when freshly mixed in water and applied, it is specially adapted for use upon tender plants. As it is only the dissolved arsenic in water that does injury to foliage, and as white arsenic is wholly, and London purple and Paris green but partially soluble in water, it seems strange at first thought that the pure arsenic should be least injurious. The reason evidently lies in the fact that white arsenic passes into solution much more slowly than the soluble arsenic in either London purple or Paris green. From the experiments of B. W. Kilgore (published in Bull. 77*b*, North Carolina Experiment Station, p. 6,) we find that one pound each of arsenic, Paris green, and London purple in a gallon of water had arsenic in solution at the end of one hour as follows: the arsenic mixture .053 grams, Paris green mixture .057 grams, and the London purple mixture .517 grams. At the end of ten days the arsenic mixture had seven times as much arsenic in solution as the London purple and fifty times

* INSECT LIFE, vol. V, p. 44.

† Rept. of Ent. U. S. Dept. of Agr., 1884, p. 327.

‡ Bull. 10, Iowa Exp. Sta., p. 404; Bull. 14, Ark. Exp. Sta., p. 5.

§ Bull. 2, Iowa Exp. Sta., p. 30; Bull. 10, Iowa Exp. Sta., p. 413.

as much as the Paris green mixtures. This explains why white arsenic if applied freshly mixed will injure foliage least, and after long standing in water most, of these three arsenites. A large number of applications of London purple, Paris green, and white arsenic in water to foliage, made by the writer at the Colorado Experiment Station during the summer of 1891 add increased evidence of the correctness of the above conclusions. White arsenic in the proportion of 1 pound to 16 gallons freshly mixed and applied to Osage Orange, Black Thorn, Apple, and Plum burned 7 per cent (estimated) of the foliage of Osage Orange as its greatest injury. One pound to 64 and one pound to 128 gallons produced very slight spotting of Plum leaves only.

During the present summer the writer has freely dusted pure powdered white arsenic upon the foliage of Box-elder, Elm, Plum, and Grape without producing any injury to the leaves.

PARIS GREEN.

This poison is an arsenite of copper and gives, on analysis,* about 68 per cent of arsenious acid (analyses differ considerably in the amount of arsenic obtained). It is said to be insoluble in water, but chemical †tests made at the North Carolina and New Jersey Experiment Stations show from 0.04 to 0.08 per cent of quickly soluble arsenic. The small amount of soluble arsenic in Paris green accounts for its being less harmful to plants than London purple as ordinarily applied. It should be remembered, however, that some have found Paris green more injurious to foliage than London purple, and that Prof. L. H. Bailey, aided by the assistant station chemist, reported in Bulletin XVIII of the Cornell Experiment Station that peach leaves burned by Paris green had no arsenic in their tissues and concluded that the injury was due wholly to external contact. Plants ‡ sprayed with dissolved arsenic at the Iowa Experiment Station in 1888 had arsenic in the tissue of the leaves after 48 hours. So it is possible that the injuries produced by Paris green upon plants, and its reputed quicker § and more certain action upon insects may be due to some property it possesses different in degree or kind from properties possessed by London purple or white arsenic.

It has also been stated by Mr. Woodworth (in Bulletin 14, p. 14, of the Arkansas Experiment Station) that Paris green is slower in its effects upon foliage than is either London purple or white arsenic. It is possible that some who have reported upon the injuries to foliage have not waited long enough to see the full effect. Not less than three weeks should elapse from time of application before final notes are taken.

---

* Bull. 18, Cornell Univ. Agr. Exp. Sta., p. 37; Ann. Rep. N. J. Exp. Sta., 1890, p. 526.

† Bull. 77*b*, N. C. Agr. Exp. Sta., p. 6; Ann. Rep. N. J. Exp. Sta., 1890.

‡ Bull. 2, Iowa Exp. Sta., p. 33.

§ Bull. 17, Ala. Exp. Sta., p. 6; Ann. Rep. St. Ent. of Ill., 1885 (experiments with Codling Moth); Bull. 12, Del. Exp. Sta.; Bull. 48, Cornell Exp. Sta., p. 272.

If the arsenites are to be applied in the old way, without the addition of lime or Bordeaux mixture, we must conclude, from all the evidence at hand, that Paris green is our most valuable arsenite for insecticidal purposes. About the only objections that can be raised to it are its higher price and its greater specific gravity than London purple.

LONDON PURPLE.

London purple is an arsenite of lime with impurities, principally coloring matter. Or, according to the analyses of Mr. H. Snyder, as published in Bulletin 18, p. 36, of the Cornell Experiment Station, London purple contains three calcium arsenites $Ca_3(AsO_3)_2$, $Ca(AsO_2)_2$, and $Ca_2(As_2O_5)$, amounting to about 72½ per cent of the entire weight of the commercial article. The impurities as given by the same authority are 23.04 per cent coloring matter, small amounts of Fe_2O_3, Al_2O_3, SO_3, and water.

The total solubility of this arsenite in water Mr. Snyder found to be 52.38 per cent. The fact that so large a portion of London purple is quickly soluble in water accounts for the serious injuries that it often does to foliage. But as we are able by the addition of lime or Bordeaux mixture to prevent these injuries, it must be ranked, on account of its cheapness and the readiness with which it remains in suspension in water, as second to none of the arsenites as an insecticide unless it be found true that it is less effectual in destroying insects.

OTHER ARSENITES.

A few other arsenites deserve passing mention because of their having been used for the destruction of insects rather than because of any great value that has yet been attached to them for insecticidal purposes.

ARSENITE OF AMMONIA.

In the report of the Entomologist of the U. S. Department of Agriculture for 1889 (p. 357), is printed a statement from the pen of Miss Mary E. Murtfeldt, saying she found arsenite of ammonia more injurious to foliage than arsenic in a watery solution, and in Bulletin 23 (p. 55) of the Division of Entomology, Miss Murtfeldt reports the same solution destructive both to leaf-feeding insects and to foliage. In the report of the Entomologist of the Department of Agriculture for 1890 (p. 264) Mr. Osborn, of Iowa, reports upon experiments with this substance and says he found it as effectual as London purple or Paris green for the destruction of insects and not injurious to foliage.

ARSENITE OF POTASH.

This arsenite, which is soluble in water, was reported by Mr. R. W. Jones in Bulletin 1, Division of Entomology (p. 51), as effectual in destroying Boll Worms on cotton. Of its effects on foliage nothing is said.

ARSENITE OF SODA AND FOWLER'S SOLUTION OF ARSENIC.

These have also been used for the destruction of insects, but have been discarded probably on account of their cost and injurious effects upon foliage.

ARSENIURETTED HYDROGEN GAS.*

This gas has been used with success by D. W. Coquillett in California for the destruction of scale-insects affecting the Orange.

ARSENICAL MIXTURES.

Within a few years past it has been found advantageous to apply the arsenites along with other substances, and chiefly for three reasons: (1) to economize time where an arsenite and a fungicide are needed upon a plant at the same time; (2) to prevent the injuries that the arsenites usually do to foliage; (3) to increase the effectiveness of the poison by using with it some sticky material as flour, paste, or molasses to make it adhere longer and in larger amount upon the leaves.

Who first conceived the idea of combining the arsenites with fungicides it would be impossible to say. The earliest mention we have been able to find of anyone having used an arsenite with a fungicide for the purpose of destroying both insects and fungi is by Mr. C. M. Weed, in Bulletin 7, vol. II, of the Ohio Experiment Station (September, 1889). The application was reported to have destroyed Potato-beetles and lessened the attack of the blight.

Now such mixtures are commonly recommended, but some of the fungicides, on account of their solvent action upon the arsenites, cannot be safely used with the latter upon plants.

†It has been proved by experiments that London purple, Paris green, and white arsenic when applied upon foliage along with Bordeaux mixture do less injury than when applied in water alone; †that London purple and Paris green are not more injurious to foliage when applied in ‡resin mixture; that foliage will suffer greater injury when arsenites are used in §sulphate of copper solution, strong soapy mixture, ‡Eau celeste or ||iron chloride solution.

Whether the arsenites may be used with ammonia carbonate of copper or not there seems to be a difference of opinion and experiments are needed to decide the matter. One important question then that should always be decided before recommending the mixture of any substance with an arsenite to be applied to plants is, how will the substance added affect the solubility of the arsenite. ¶If it renders it

---

* Rep. of Ent., Dept. of Agr., 1888, p. 127.

† Bul. 10, Iowa Exp. Sta., p. 417; Bul. 4, vol. III, 2d Series, Office Exp. Sta., p. 143; Bul. 48, Cornell Exp. Sta., p. 274; Bul. 77*b*, N. C. Exp. Sta., p. 5.

‡ Bul. 10, Iowa Exp. Sta., p. 415.

§ Bul. 10, Iowa Exp. Sta., p. 418.

|| Bul. 77*b*, N. C. Exp. Sta., p. 8.

¶ Bul. 77*b*, N. C. Exp. Sta., p. 10.

more soluble, it will cause it to do greater injury, if it renders it less soluble it will cause it to do less injury to foliage. In applying arsenites and fungicides together the benefit is not wholly in economizing time or lessening the injuries to foliage. Mr. Lodeman, of the Cornell Experiment Station, has reported (Bul. 48, p. 272) decided fungicidal properties for London purple and Paris green.

ARSENITES WITH LIME TO PREVENT INJURY TO FOLIAGE.

So far as we are aware, lime is the only substance used with the arsenites for the express purpose of diminishing the injuries that they ordinarily do to plants, and the first experiments made with this object in view seem to be those reported in Bulletin 10 of the Iowa Experiment Station. These experiments proved beyond a reasonable doubt that London purple or Paris green can be used liberally in wet applications upon the tenderest foliage when there is a little lime in the water. The results reached in Iowa have been abundantly verified since by the writer in Colorado, and by * other entomologists in several States.

Just the amount of lime necessary in each case to precipitate the soluble arsenic, and so protect foliage from injury, was determined at the New Jersey Experiment Station † by Dr. J. B. Smith with the aid of the assistant station chemist, and also by Mr. B. W. Kilgore, assistant station chemist in North Carolina. ‡

Dr. Smith recommends foreach pound of London purple three-fourths of a pound of lime; for each pound of arsenic, 1½ pounds of lime; and for Paris green a small amount. Mr. Kilgore recommends for London purple and Paris green equal weights, and for arsenic a double weight of lime. In either case the amounts recommended are in excess of what would be needed as indicated by the analyses.

What seems unaccountable to the writer is that in all his experiments, both in Iowa and Colorado, lime added to a fresh mixture of arsenic in water and applied to foliage has in all cases resulted in much greater injuries than when arsenic was applied in the same manner without lime. When the arsenic was first dissolved in the water lime would lessen the injuries as in the case of London purple and Paris green.

ADHESIVE SUBSTANCES USED WITH THE ARSENITES.

§ When flour paste or other adhesive substance is used with arsenical mixtures, wet or dry, the poison should be used more sparingly, as anything that will cause more arsenic to adhere to the leaves will cause increased burning of the foliage.

---

* Bul. 4, No. 2, Ohio Exp. Sta.; Bul. 75, N. J. Exp. Sta.; Bul. 77*b*, N. C. Exp. Sta.

† In Rep. of Exp. Sta. for 1890.

‡ Bul. 77*b*, N. C. Exp. Sta.

§ Bul. 10, Iowa Exp. Sta., p. 408.

ARSENITES WITH KEROSENE EMULSION.

Agents of the Division of Entomology* and others† have experimented with the arsenites in kerosene emulsion for the destruction of haustellate and mandibulate insects with one application, but the combination has, so far, proved a failure.

In such a mixture the arsenite will separate in buttery clots and rise to the surface or cling to the inside of the vessel, and the separation of the oil from the emulsion is also hastened.

There seems to be no reason why the arsenites could not be used with pyrethrum.

THE ARSENITES AS EXTERNAL IRRITANTS.

The arsenites are usually thought of as only being destructive to insect life when taken internally.

In the report of the Michigan board of agriculture for 1888 Mr. L. H. Bailey, of South Haven, Mich., is reported as saying he had been entirely successful in ridding horses of ticks and cattle of "black lice" with a single application of London purple in water.

Mr. H. Garman (in Bul. 21 of the Kentucky Exp. Sta.) says he has found London purple more destructive than pyrethrum when applied to plant-lice.

In the Report of the Entomologist of the U. S. Department of Agriculture, 1890 (p. 142), Mr. D. W. Coquillett reports success in destroying scale-insects with arsenic, in combination with each of the following mixtures:

Muriatic acid, mercury and quick lime.
Muriatic acid, zinc and quick lime.
Muriatic acid and zinc.
Muriatic and nitric acids, mercury and quick lime.
Muriatic and nitric acids and copper.
Muriatic and nitric acids and zinc.

And in the Report of the Entomologist of the U. S. Department of Agriculture, 1886 (p. 557), Mr. Coquillett reports having used the arsenites successfully in the proportions of 1 pound to 4 gallons, 1 pound to 6 gallons, and 1 pound to 8 gallons of water for the destruction of scale-insects. So the arsenites should not be considered poisons that kill only when taken internally. They are of some, perhaps much, importance as external irritants also.

In the discussion Dr. Beal suggested that it might be desirable to regulate the amount of arsenic in Paris green by law.

Mr. Weed thought London purple more constant in the amount of arsenic it contained than Paris green, but Mr. Gillette believed the reverse to be true, and thought the general testimony was to this effect.

*Rep. of Ent. U. S. Dept. of Agr., 1886, p. 557.
†Bul. 10, Iowa Exp. Sta., p. 414.

Mr. Galloway remarked on the peculiar invigorating effect which Bordeaux mixture has when sprayed on plants, even when they are not diseased or injured in any way. The solutions of carbonate of ammonia on the contrary were known, when constantly used on vegetation, to have a very injurious effect in course of time.

On invitation from the members of the Association Mr. Galloway, of the Division of Vegetable Pathology at Washington, gave a brief account of some recent work done in his Division on a widespread bacterial disease of melons and other related plants. It had been found to be disseminated very largely by the agency of insects, among which were *Diabrotica vittata*, *D. 12-punctata*, and an Epitrix. The disease appears suddenly among vines, and in the course of a few hours they become wilted as they would if cut off by the roots. Eventually they die completely. Several species of bacteria were found in the tissues of the affected plants by Dr. Erwin F. Smith, and at least one of these was, after isolation, capable of producing the disease when introduced into sound plants. Of hundreds of cases examined all had been started by the work of insects, and it was found that the plants could be completely defended from the disease by covering them so as to exclude insects.

Mr. Webster had observed the disease in Ohio where he had witnessed its occurrence in groups of plants. He had experimented with a view to checking it by applications of Bordeaux mixture.

Mr. Smith found it very common also in New Jersey.

Mr. Garman had observed the same disease in Kentucky.

The President announced that a free boat ride on Lake Mendota was offered to members of the association by the American Microscopical Society.

On motion the association then adjourned to meet at 2 o'clock.

THIRD SESSION—AUGUST 15.

The association was called to order by the president at 2 p. m.

Mr. Webster, as chairman of the committee appointed by the chair to consider means of raising funds to pay the annual expenses of the association, reported as follows:

Your committee beg leave to report that they have examined the constitution and by-laws concerning membership fees and dues and propose the following:

ARTICLE II, Section 2. Omit the words, "assessment of not less than 25 cents on the members in attendance at the meeting," and substitute therefor the words, "annual dues of 50 cents, to be paid to the secretary within one month after the meeting by each resident member."

F. M. WEBSTER, *Chairman.*
JOHN B. SMITH.
A. D. HOPKINS.

On motion the report was adopted.

Mr. Webster offered a resolution relating to the publication of the proceedings of the present meeting, as follows:

Resolved, That we respectfully request the publication as heretofore of the proceedings of the present meeting in INSECT LIFE, and that the secretary be requested to prepare the same for publication, and that he be asked to prepare an abstract of the proceedings for publication in the *Canadian Entomologist.*

The resolution was adopted.

Mr. Aldrich, of Idaho, proposed Mr. G. C. Davis for membership.

It was moved by Mr. Webster that the chair be requested to appoint a committee of three to nominate officers for the coming year.

The President called attention to section 3 of Article II of the by-laws, in which unanimous consent of the voting members is required to suspend the regular method of electing officers by ballot after open nomination.

It was voted this consent be granted, and the chair then appointed on the committee Messrs. Osborn, Webster, and Weed.

The following paper was then read:

DESTRUCTIVE SCOLYTIDS AND THEIR IMPORTED ENEMY.

By A. D. HOPKINS, *Morgantown, W. Va.*

Within the last three years enough evidence has come under my observation of the destructive powers of Scolytid bark and timber beetles to convince me that they are among the worst enemies of our forest trees. In fact it is my belief that bark and timber beetles have caused the loss of more property, having a commercial value in West Virginia, within the last ten years than that occasioned by any other single class of insects within the same time.

The destruction in our pine and spruce forests alone, resulting from the primary attack of a single species of bark beetle, has caused, since 1890, the loss of timber having a value of not less than a million and a half dollars.

Certain great devastations in the spruce forests of Maine, New Hampshire, New York, New Brunswick, France, and Germany since 1860 were evidently the work of bark beetles, which, aided by timber beetles, not only cause the death of trees, but so damage the wood and hasten its decay that the timber soon becomes worthless, and in this country proves almost a total loss.

The destructive species of Scolytids may be divided into two classes, one class, including only a limited number, makes the primary attack, or prefers to enter the bark, roots, and wood of living trees and other plants. The other class has a preference for injured, unhealthy, or felled trees, etc., the bark and wood of which these insects infest for the purpose of perpetuating their species. The first is primarily to blame for causing the death of trees, or at least a diseased condition, while the

second is responsible for the death of the diseased ones and for causing the premature decay of the wood. All bark and timber beetles are, therefore, more or less destructive in their habits, their power of destruction depending more than anything else perhaps upon their numbers.

Nature has provided plant life with the power, to a certain extent, of resisting the attack of enemies and with natural means of healing wounds, recovering from disease, and other injuries occasioned by severe drought, cold, etc. Therefore, in order for a single species of insect enemy of a tree to attack and kill it it must not only infest a vital part, but must occur in sufficient numbers to overcome all resistance. This is especially the case with destructive Scolytids, which, to accomplish this end, must enter the bark or wood of living trees, where they meet with the flowing sap, which offers the greatest resistance and most difficult to overcome. Therefore, no single species of Scolytid bark beetle can cause the death of large or small forest trees unless occurring in immense swarms. In fact, it is doubtful if any single species could overcome the resistance thus offered by vigorous, healthy trees without the assistance of numerous species of Scolytids and other insects which always come as reënforcements after the first attack is made. Hence, to cause a widespread devastation of timber, numerous species must work in concert. One species makes the primary attack and causes at once an unhealthy condition of the bark and tree. This diseased condition, if ever so slight, attracts other species to the affected tree. One or more kinds will attack the bark and wood at the base, others attack the bark at different points on the trunk, others infest the large and small branches, while still others enter the bark and wood of the terminal twigs, until the infested trees may be the hosts of twenty-five to forty species of Scolytids, each aiding the other in making the conditions favorable for the perpetuation of their species, and all contributing to the death and premature decay of their host.

Thus, through certain favorable conditions (the increased numbers of the species which are capable of existing in the green bark of living trees being the most favorable), an invasion may be started which in a few years results in the loss of millions of dollar's worth of property.

The fact that the primary attack of one species makes the conditions favorable for the increase of others, which in turn contribute to the increase of the first, is an important feature to be considered, in our effort to discover methods of checking or preventing the ravages of this class of insects. If the numbers of those making the primary attack can be reduced below their power of causing a diseased condition of the trees, the trouble of which they are the primary cause must end. If, on the other hand, their undue increase can be prevented, invasions by them can not occur.

Thus, it is evident that, before considering a remedy against an invasion of Scolytids, we must discover the species to blame for the pri-

mary attack, and become as familiar as possible with its life history and habits, as well as the life history and habits of other species coöperating with it, and also study other causes which might contribute to or oppose the progress of their destructive work.

In the consideration of preventive measures against invasions of Scolytids, we must study the habits of the different species of the family in order to ascertain which of them are capable of causing diseased conditions of trees, or through increased numbers, their death.

During an investigation of serious trouble caused by these insects in our State I have given especial attention to these subjects. After discovering the species to blame for the primary attack, and its principal aids in continuing the devastations, methods of checking the increase of the destructive kinds and protecting forests of healthy timber from their invasions were considered.

I was convinced from the first that no artificial remedy, such as cutting and burning the infested trees, the removal of the bark from the trunks, etc., could be successfully applied in our West Virginia forests. Therefore, my attention was turned toward the study of the parasitic and predaceous enemies of Scolytids, with a view of ascertaining the most desirable kinds with which to conduct experiments, in utilizing them as a means of checking the increase of the destructive species.

An enemy of Scolytids was desired which would not have to depend on one or two species for its existence, but could readily adapt itself to different species and to varying conditions.

I found that while Scolytid bark beetles have numerous parasitic Chalcidid, and Braconid enemies, few, if any of them, in my opinion, can be relied upon as introduced enemies to suppress or prevent an invasion of these beetles. I found, however, among their predaceous enemies, that the habits of certain species of the coleopterous family Cleridæ were such, if these beetles occurred, or could be introduced in sufficient numbers in the infested forests this would certainly have the desired effect.

In my search for literature regarding native and European Clerids I found, in a report upon forestry, by F. B. Hough, 1882 (p. 264), as copied from a special publication of the French Forestry Administra, in connection with the Universal Exposition at Paris, that a European species, *Tillus formicarius*, was mentioned as being a "foe of *Bostrichus typographus* that pursued them without mercy" during an invasion of these bark beetles in the forest of *Abies excelsa* in the Jura mountains, from 1868 to 1872. This led me to make further inquiries in regard to this and other European enemies of Scolytids and on October 13, 1891, I wrote to my correspondent, Oberfoerster W. Eichhoff, of Strasburg, Germany, asking him to send me some pinned specimens of insects known to be special enemies of European Scolytids. At the same time I indicated to him my desire to introduce live examples of

such species as in his judgment would prove beneficial in this country as natural enemies of *Scolytus rugulosus*, *Polygraphus rufipennis*, *Dendroctonus terebrans*, and *Dendroctonus frontalis*. Among the thirty-one species of pinned specimens received from him on November 12, he mentioned *Clerus formicarius* as being "beyond a doubt the best destroyer of Scolytids."

On May 30, 1892, I again wrote to Mr. Eichhoff, mentioning the damage to our forests by *Dendroctonus frontalis*, and stated that I was very anxious to try the experiment of introducing *Clerus formicarius* into our forests as an enemy of this and other bark beetles. In his reply of June 26 he referred me to Director C. Schaufuss, of the museum at Meissen, Saxony, as one who could give me efficient aid in this matter. Upon further investigations of the ravages of the bark beetles in our forests I prepared a special report, dated July 9, which was addressed to the principal owners of the spruce and white pine timber in West Virginia. In the closing paragraph of this report, reference was made to the successful introduction of the Vedalia into California, and the possibility of introducing in a like manner insects from Europe which would feed upon the Destructive Bark-beetle. It was suggested that it might be necessary to make a special trip to France and Germany for this purpose, and that if the timber interests of the State would share in the expenses of such a venture, this object might be speedily accomplished. In reply to this communication six of the principal timber companies of the State responded with liberal contributions, and I was authorized to proceed at once to Europe for the purpose of studying the insect enemies of European Scolytids, and to collect and import to this country such species as in my judgment would prove efficient in checking the ravages of insects in our forests.

In studying the enemies of European Scolytids, I found, as in this country, numerous Hymenopterous and Coleopterous parasitic and predaceous species in company with the Scolytids in the bark of the infested trees, but realizing to the fullest extent the danger of introducing insects into this country which might prove injurious as well as beneficial, I took every precaution in the selection of the species. Out of quite a number of enemies of Scolytids observed and considered, only one, *Clerus formicarius*, was selected, primarily on account of its being regarded as the greatest destroyer of European bark beetles; secondarily on account of the general opinion of entomologists and forest officials whom I consulted, and my own convictions from a personal study of its habits, that it would not be injurious.

The first examples of this European bark-beetle destroyer collected by me were taken in the Hagenau forests of *Pinus sylvestris*, on August 29, in the first injured tree examined, and they were afterwards found common in the larva, pupa, and imago stages in their pupa cases or winter quarters in the outer bark of large and small trees which had been injured or broken by storm and heavy snow. The bark of these

injured trees was infested principally by the common European bark beetles, *Hylesinus* (*Myelophilus*) *minor* Hart., and *Hylesinus* (*Myelophilus*) *piniperda* Linn. The larva of the Clerid had evidently been devouring the larva and pupa of the latter species at a fearful rate, for in many instances, scarcely one had escaped where there had apparently been thousands. The Clerid was also found under the same conditions in the forests near Meissen in the Kingdom of Saxony, and were taken from the bark of spruce logs in the Lauterbrunnen Valley in Switzerland, where they had been feeding on *Tomicus cembrae*, Heer.

Upon my return to this country, with something over a thousand specimens, a small colony of the beetles and larvæ were placed in a pine woods near Morgantown, on October 10, 1892, being the first examples set free in America. The remainder were successfully kept over winter in the larval and pupal stages, and between April 20 and May 10 they were distributed to the timber companies which had contributed to the expenses. Colonies of 25 to 100 were placed by me, or under my special supervision, on and in the bark of trees, logs, and tops, where the conditions were most favorable for their propagation.

Eight importations, numbering 2,082 examples, have since been received from collectors in Alsace and Saxony, Germany, and the living examples have been sent to the timber companies in five different counties, with special instructions for their proper location in colonies the same manner as first mentioned. In all 26 colonies have been placed in different sections of our forests. The conditions surrounding each colony are most favorable for the clerids to thrive and increase, and we have every reason to believe that they will do so under their changed conditions, but as yet we have no means of ascertaining to what extent they have multiplied, and of course it is too early to expect results..

There is one interesting fact, however, that I have observed this season regarding the destructive Pine Bark-beetle *Dendroctonus frontalis*, and that is that its numbers have been very greatly reduced since last fall, consequently at this time very little if any timber is dying.

On the 24th of July, 1892, I found this species attacking and mining beneath the bark of living trees, in which they occurred in immense numbers. By the latter part of September a brood had emerged from the bark of the same tree while the leaves were yet green, and those that had emerged were entering the bark of other living trees. In November the bark of the same trees were found to be infested by countless thousands of the insects in all stages from eggs to adults. Trees so affected subsequently died, but through persistent search in the bark of such trees in different sections of the State I have failed, as yet this season, to find a single living example of *Dendroctonus frontalis*. Hence the trouble, as caused by this species, is evidently at an end in West Virginia, for the present at least.

No other species of Scolytids infesting the same trees seem to have been affected by the cause which it would seem has rendered *Dendroctonus frontalis* almost extinct. In fact the great number of trees that died last summer and fall were found last spring to be infested by immense numbers of bark and timber beetles of different species. These have since emerged, and it would seem that the only danger to be apprehended from a continuation of a trouble like that we have mentioned would be from the attack of some of the species which have thus emerged from the dead trees, for it is evident that unless they find favorable conditions in the felled trees, tops, stumps, etc., in lumbering regions they must either attack and kill living trees or they must perish.

One species, the Turpentine Bark-beetle, *Dendroctonus terebrans*, has already made a desperate effort in this direction. Early in May the adults emerged from the trees in which they had bred, but failed to find dying trees, the bark of which they preferred to infest for the purpose of depositing their eggs. Then followed a remarkable and interesting occurrence, probably never before observed in the life habits of this and other species of Scolytids. They, with numerous other members of the Scolytid family, including both bark and timber beetles, must have started, with one accord, in search of more favorable conditions for their propagation, for they occurred in different sections of the State, at about the same time, in great swarms like migrating locusts. Specimens were sent to us accompanied by startling accounts of plagues of bugs that invaded mill yards, furniture shops, newly painted houses, etc. They were reported as coming like a hailstorm against the windows, and in at the open doors like swarms of bees, and that the air on all sides was full of them. During my absence from Morgantown (where our station is located) one of these migrating swarms of Scolytids invaded the town and occurred at certain houses and at furniture factories in such immense numbers that some of the people became alarmed. The report was started that Hopkins's German bugs had devoured all of the pine bugs and were going to prove like the English Sparrow, a universal pest. It was probably well for me that I was absent at the time.

The men were painting a new greenhouse at the station at the time, and the number of the beetles attracted to the building evidently by the odor of turpentine, were so great that the men were exceedingly annoyed in their work. When I returned to the station, several days after, I found evidence of their numbers in the handfuls of dead beetles that failed to escape from the greenhouse.

Dendroctonus terebrans occurred in by far the greater numbers in these migrating swarms, and when they failed to find dying or injured trees they attacked living Pine of all kinds, Black Spruce and Norway Spruce, entering the bark at the base of the trees. Some of the trees thus attacked in May were examined July 15, and the bark near the point of the attack was found to contain parent adults, eggs, and full-

grown larvæ, the larvæ occurring in great numbers surrounded by the flowing turpentine. Trees thus infested were still living but the injury will probably cause a diseased condition of the trees, which will attract other species and result in their final death, thus we may be on the eve of a new destructive invasion like that which has just passed. Other species, like *Polygraphus rufipennis*, *Tomicus calligraphus*, and *Tomicus cacographus*, which are capable of existing in green, sappy bark, occurred in such abundance in the dying spruce and pine trees last spring that it is evident they must exist in the forests in great numbers, and are ready to attack trees showing the slightest indication of disease or weakened vitality, if they do not make a primary attack.

Therefore, the imported enemy will find abundant food and favorable conditions for its rapid increase in the infested bark of felled trees, tops, and stumps in lumbering regions in which or near which the colonies have been placed.

The imported Clerid does not confine itself to one or two species of bark beetles in one kind of trees, but the adults, it would seem, will attack and devour the adults of any species of bark and timber beetles found in the United States, and their larva will feed on the eggs, larvæ, pupæ, and young beetles of any species infesting the bark of pine and spruce trees. In fact, they are inclined to make themselves generally obnoxious to the little bark pests.

It would seem that all of the conditions necessary for the imported Clerid to multiply and become an efficient protector of our pine forests from future destructive invasions of bark beetles are most favorable. *Dendroctonus frontalis*, evidently the most destructive enemy of our pine forests, has, from some cause, been reduced far beyond its destructive powers. Other species which have depended upon it for the primary attack are, it would appear, somewhat demoralized on account of the disappearance of their benefactor. The large amount of felled timber found in the several lumbering regions will probably attract the larger portion of other threatening bark beetles away from the green trees, and by the time *Dendroctonus frontalis* can again marshal sufficient forces to successfully attack and kill the trees, they will, it is hoped, be met with a force of enemies led by the European Bark-beetle Destroyer, which will successfully repel them and thus save our forests in the future from destructive invasions of bark beetles.

Mr. Smith, in discussing this paper, said that he thought the experiment entered upon in West Virginia well conceived, but thought that parasites did not greatly benefit the farmer. Mr. Hopkins, in reply, stated that it required enormous numbers of the Scolytids to kill the pine trees, and that his idea was to get some means of reducing the numbers of the beetles and not to completely exterminate them. That parasites

were a benefit to agriculture was, he thought, demonstrated by the irruptions of pests which took place when, by some means, they reached localities from which their parasites were absent.

The following paper was then read:

PARASITIC AND PREDACEOUS INSECTS IN APPLIED ENTOMOLOGY.

By C. V. Riley, *Washington, D. C.*

The importance to man, and especially to the agriculturist, of the parasitic and predaceous insect enemies of such species as injure vegetation, has been recognized by almost all writers on economic entomology. Indeed, it is a question whether the earlier writers did not attach too much importance to them; because, while in the abstract they are all essential to keep the plant-feeding species in proper check, and without them these last would unquestionably be far more difficult to manage, yet in the long run our worst insect enemies are not materially affected by them, and the cases where we can artificially encourage the multiplication of the beneficial species are relatively few. While fully appreciating the importance of the subject, therefore, it is my purpose in this paper to point out the dangers and disadvantages resulting from false and exaggerated notions upon it.

There are but two methods by which these insect friends of the farmer can be effectually utilized or encouraged, as, for the most part, they perform their work unseen and unheeded by him, and are practically beyond his control. These methods consist in the intelligent protection of those species which already exist in a given locality, and in the introduction of desirable species which do not already exist there.

The first method offers comparatively few opportunities where the husbandman can accomplish much to his advantage. That a knowledge of the characteristics of these natural enemies may, in some instances, be easily given to him, and will, in such instances, prove of material value, will hardly be denied. The oft-quoted experience which Dr. Asa Fitch recorded, of the man who complained that his rosebushes were more seriously affected with aphides than those of his neighbors, notwithstanding he conscientiously cleaned off all the old parent bugs (he having mistaken the beneficial ladybirds for the parent aphides) may be mentioned in this connection. Other cases will recur to you and I will mention one rather striking experience related by my assistant, Mr. L. O. Howard. The Army Worm (*Leucania unipuncta*) was overrunning a large and valuable field of timothy and threatened the destruction of the adjoining fields. The insect was as yet, however, circumscribed, and susceptible of remedial treatment. The owner of the field, observing the buzzing swarms of the Red-tailed Tachina-fly, assumed that the fly was the parent of the worms, and as the former

was an active, winged creature, capable of extended flight, he concluded that remedial work was useless, since the flies could, and doubtless would, deposit their eggs over the entire surrounding country. As a consequence the worms were allowed to travel to the adjoining fields and the injury thus increased through ignorance of the fact that the Tachina flies were the most important of the parasitic enemies of the worm. For many years well-informed gardeners in parts of Europe have practiced collecting ladybirds and some of the ground beetles to liberate upon plants infested by plant-lice or by cutworms. The characteristics of these two families, Coccinellidæ and Carabidæ, should be taught in our schools, as a definite knowledge of certain species, which is readily acquired, may often be turned to account in a limited way by the cultivator.

In a few cases like this there is no reason why the farmer should not be taught with advantage to discriminate between his friends and his foes, and to encourage the multiplication of the former; but for the most part the nicer discriminations as to the beneficial species, some of the most important of which are microscopically small, must be left to the trained entomologist. Few of the men practically engaged in agriculture and horticulture can follow the more or less technical characterizations of these beneficial species, and where the discriminating knowledge is possessed it can, as just intimated, only exceptionally be turned to practical account. Thus our literature on this subject in the past has been of interest from the entomological rather than from the agricultural point of view, as most writers on economic entomology have contented themselves with describing and illustrating such beneficial species.

In other cases much good may be done without any special knowledge of the beneficial forms, but as a result of a knowledge of the special facts which enables the farmer to materially encourage the multiplication of parasitic species while destroying the plant-feeding host.

The Rascal Leaf-crumpler (*Mineola indiginella* Z.), a common insect which disfigures and does much damage to our apple and other fruit trees and which hibernates in cases attached to twigs, is a case in point. Many years ago I urged the importance of preserving the several parasites known to prey upon it, in the following language:*

The orchardist has but to bear in mind that it (the leaf-crumpler) is single-brooded and that it passes the winter in its case, and he will understand that by collecting and destroying these cases in the dead of the year when the tree is bare, he effectually puts a stop to its increase. * * * Whether collected in winter or pulled off the trees in spring or summer, these cases should always be thrown into some small vessel and deposited in the center of a meadow or field away from any fruit trees. Here the worms will wander about a few yards and soon die from exhaustion and want of food, while such of the parasites, hereafter mentioned, as are developed or in the pupa state will mature and eventually fly off. In this manner, as did Spartacus of old, we swell the ranks of our friends while defeating our foes.

---

*Fourth Report, Insects of Missouri, 1871, p. 40.

The practical value of this suggestion was subsequently fully demonstrated, and especially by the late D. B. Wier, who, at a meeting of the Illinois Horticultural Society, as secretary of a committee appointed by said society to consider the best means of securing coöperation in the warfare against the fruit-growers' insect enemies, announced that this policy had been followed with happy results.

A similar course was urged by me in the case of our common Bag-worm (*Thyridopteryx ephemeræformis*). This species, as we know, is also subject to parasites, and the bags or cases which are collected in winter, instead of being burned, should be allowed to remain until the middle of the next summer in some vessel well separated from trees and shrubs, in order that the young worms, when they hatch in spring from the eggs contained in the female bag, may perish, while the parasites develop and escape. Prof. J. H. Comstock has suggested in a similar way the placing of the hand-collected chrysalides of the imported Cabbage Worm (*Pieris rapæ*) in boxes covered with wire netting, in order to admit of the ready escape of the little Chalcid parasite (*Pteromalus puparum*) and at the same time retain such of the butterflies as may issue—a practice which had, I believe, been successfully employed in Europe. Other similar cases of this mode of encouragement will occur to you, but, as already stated, with comparatively few exceptions, such as those indicated, the multiplication of our parasitic and predaceous species on the line of the first method is practically beyond our control.

It is quite different in the second method of dealing with beneficial insects, for here man has an opportunity of doing some very effective work, and it is only within comparatively recent years that the importance of this particular phase of the subject has been fully realized. The Rev. C. J. S. Bethune, of Canada, was probably the first entomologist to suggest, in one of the earlier volumes of the *Canadian Farmer*, the importation of the European parasites of the Wheat Midge (*Diplosis tritici*) into America, on the supposition that this cosmopolitan species might thus be kept in check on this continent to the same extent that it was in Europe. So far as I am aware, the attempt was never actually made, and though some subsequent correspondence was entered into between Fitch and Curtis, and later between Walsh and some of his English friends, nothing tangible resulted. The matter was, in fact, never seriously studied with this purpose in view.

The importance of this phase of the subject was early forced upon my attention, as it was upon that of others, and is frequently referred to in my earlier writings. Thus, in 1869–'70, in studying the parasites of the Plum Curculio, it became evident that they were of such a nature that they could easily be transported from one locality to another, and I distributed from Kirkwood, Mo., *Sigalphus curculionis* Fitch and *Porizon conotracheli* Riley to several correspondents in other parts of the State. I also urged a similar course with regard to some of the parasites of the Coccidæ, which it happens may be easily transported from

one place to another in their undeveloped or adolescent stages.* Le Baron, in his studies of the Oyster-shell Bark-Louse of the Apple and one of its parasites (*Aphelinus mytilaspidis*), transported scale-covered twigs during winter from Geneva, Ill., to Galena, Ill., with beneficial results. The experiment was conducted on a small scale, but the parasites issued and became domiciled in their new locality, thus proving the practicability of his scheme. In neither my own experiments nor in Le Baron's, however, was sufficiently thorough examination made to prove that the parasites did not already exist in the localities in which they were colonized.

Planchon and myself introduced *Tyroglyphus phylloxeræ* from America into France in 1873,† and it became fully established, as subsequent correspondence and observation showed. In 1874 efforts were made to send over from England to New Zealand certain Aphid parasites to check the alarming increase of those plant pests there, and while I have no records at hand to show with what success, the later successful introduction of bumblebees to the latter country to fertilize the red clover is well-known history. In his report upon the parasites of Coccidæ in the Annual Report of the Department of Agriculture for 1880, Mr. Howard gave the subject some theoretical attention and elaborated upon the ease with which Coccid parasites could be transported from one part of the country to another during winter. He suggested the experiment of transporting *Dilophogaster californica* from the Pacific coast to certain of the Southeastern States, where it might be expected to prey upon certain large species of Lecanium. In 1883, after previous futile attempts by myself and Mr. Otto Lugger, and with the assistance of G. C. Bignell, esq., of Plymouth, England, the living cocoons of *Microgaster glomeratus*, a common European parasite of *Pieris rapæ*, were successfully imported by the Department and the colonization of the species was established, not only in the District of Columbia, but in Iowa, Nebraska, and Missouri, as specimens were simultaneously sent to the agents of the Division in those States.‡ It has become so widely distributed since then as to lead to the inference that it must have been previously introduced at some other points, though the spread of an introduced species, even when introduced at a single point, is often so rapid that it surprises us, especially of a species that is winged, as evidenced by the spread of the Horn Fly (*Hæmatobia serrata*) over the whole eastern United States in about four years. Later, in 1891, with the aid of Mr. Fred. Enock, of London, a successful effort was made to introduce into this country from England an important Chalcid parasite of the Hessian Fly, *Entedon epigonus* Walker (*Semiotellus nigripes* Lind.). The details of this experiment will be

*Third Rep., Ins. Mo., 1870, p. 29; Fifth Rep., do., 1873, p. 90.

† Sixth Report, Ins. Mo., 1874, p. 55.

‡ Report of the Etomologist in Rep. U. S. Dept. Agric. for 1884, p. 323.

found in my published writings, especially in my report as U. S. Entomologist for 1891, and it is only necessary to state at this time that parasitized puparia of the Hessian Fly were received in large numbers and distributed to various points, and placed in the care of competent observers in Illinois, Indiana, Michigan, and Canada. The results so far have not been marked, and but one positive report as to the acclimation of the parasite has been received, viz, from Prof. S. A. Forbes, of Champaign, Ill. I am of the opinion, however, that the lack of evidence from other points is due almost entirely to lack of proper examination, and I have every hope that the species will before long be found to have obtained a secure foothold at all of the several points of introduction. It is a very difficult matter to ascertain the existence of a parasite of this minute size, except when it occurs in great numbers. It requires an eye trained not only to the examination of these minute creatures, but one familiar with the allied imported species and native species. The reason for attempting the introduction of this particular species was simply that in England it was found to be far more abundant and far more beneficial than any of our native species have so far proved.

The present year I have become interested in the matter of the importation of a predaceous Noctuid (*Erastria scitula*) which preys upon the Black Scale (*Lecanium oleæ*) in south Europe and helps materially to keep it in check. With the help of Prof. H. Rouzaud, of Montpellier, France, who has studied the habits of this insect with extreme care, I hope to establish it in southern California, where the climatic conditions are sufficiently close to those of south Europe, and where the Black Scale does great damage to olive orchards and to oleander trees, and also affects less seriously the Orange and Lemon. The Black Scale has already an important enemy in California in the shape of the Dilophogaster above mentioned, but the latter is only two-brooded, and the scale insect, multiplying more rapidly, outstrips it in the race for maturity. The Erastria, on the contrary, passes through five or six generations in the course of a summer, and, as it is purely predaceous, it will, I believe, prove a most useful auxiliary against the Black Scale, especially if brought over without its parasites.

So far I have spoken only of the insects which have been imported into this country, but some effort has also been made in the opposite direction. Thus we have endeavored (and with some success) to return the service done us by sending to Australia and New Zealand some of our predatory Coleoptera, some of the Pacific coast parasites of the Codling Moth, and a species of the interesting genus Raphidia, which also preys upon the Codling Moth.

In 1887 and 1888 the now well-known importation of *Vedalia cardinalis* from Australia and New Zealand to California, to prey upon *Icerya purchasi*, was successfully carried out. The history of this striking example of the beneficial results that may, in exceptional

cases, flow from intelligent effort in this direction, is now sufficiently well known to American economic entomologists; but anticipating that we shall have foreign delegates among us, and that our proceedings will be published more widely than usual, it will, perhaps, be wise to give the salient historical facts in the case, even at the risk of some repetition of what has been already published. In doing this the indulgence of the society is craved for the prominence of my own part in the work, rendered necessary by the disposition in some quarters to distort the facts.

The Fluted Scale, otherwise known as the White or Cottony-cushion Scale (*Icerya purchasi* Maskell), is one of the largest species of its family (Coccidæ), and up to 1888 had done immense injury to the orange groves and to many other trees and shrubs of Southern California. From Australia, its original home, it had been imported into New Zealand, South Africa, and California, the evidence pointing to its introduction into California about 1868, and, probably, upon *Acacia latifolia.*

In my annual report as U. S. Entomologist for 1886 will be found a full characterization of the species in all its stages; but the three characteristics which most concern the practical man, and which make it one of the most difficult species to contend with, are its ability to survive for long periods without food, to thrive upon a great variety of plants, and to move about throughout most of its life.

The injuries of this insect, notwithstanding the efforts to check it, kept on increasing, and some ten years ago I felt that the work of this particular species and of others which seriously affected the fruit-growing interests of Southern California justified the establishment of agencies there. Up to this time no special entomological effort had been made by the Government on behalf of the fruit-growers of the Pacific coast. Through agents stationed, the one at Los Angeles, the other at Alameda, a course of elaborate experiments was undertaken as to the best means of treating the insects affecting the Orange there, and more particularly this Fluted or Cottony-cushion Scale. During the progress of these investigations, however, the fact impressed itself upon my mind that we had here an excellent opportunity of calling to our aid its own natural enemies, for while there were some doubts as to the origin of Icerya, the question was finally settled to my own satisfaction that it was of Australian origin, and that in its native home it was not a serious pest, but was kept subdued by natural checks. These facts were not positively ascertained without a good deal of correspondence and investigation, involving, in fact, a trip to France, as has been set forth in my published writings upon the subject.

In my report as U. S. Entomologist for 1886, in an address before the State Board of Horticulture at Riverside, California, in 1887; in a paper before the Philosophical Society of Washington in the winter of 1888, and elsewhere, I urged, with all the force at my com-

mand, the advisability of endeavoring to introduce the natural enemies which were known to keep it in check in Australia. Certain indigenous species had been discovered preying upon it in California, and I expressed the belief that, as they increased, the fruit-growers would get more and more relief from the Icerya; but I also urged that there was much more chance of success from those which keep it in check in its native home, and which were not imported with it to the countries of its introduction. The case was exceptional, and the attempt thus urged gave every promise of a rich reward. Efforts were made to introduce some of these natural enemies through correspondence, especially with the late F. S. Crawford, of Adelaide, with what ultimate results the subsequent success of Vedalia forever rendered uncertain.

The Hon. H. H. Markham, present Governor of California, was at that time a Representative in Congress, and through him chiefly, but also through others, I urged upon Congress the desirability of sending some one to Australia to make a thorough study of the subject with a view of introducing those natural enemies. Again, in the winter of 1887–'88 appeals were made to Congress, not only of a personal nature, but through memorials from various societies in California, for an appropriation to send one or two men to Australia to collect and increase these natural enemies. Congress, however, failed to make any specific appropriation, and also failed to remove the restriction in the appropriation to the Division of Entomology which limited traveling expenses to the United States and prevented independent action of the Department of Agriculture. It happened, however, that about this time an appropriation was made and a commission created to represent the United States at the Melbourne Exposition, and, with the appreciative aid and sympathy of the Hon. Norman J. Colman, Commissioner of Agriculture, I took active steps to gain the coöperation of the Secretary of State in my pet scheme, and by an arrangement with the Department of State, accepted by the commissioner to said Exposition, Hon. Frank McCoppin, the Department of Agriculture was finally enabled to send to Australia two agents of the Division of Entomology, one of them to be under my instructions, and the expenses of both, within the sum of $2,000, to be paid out of the appropriation for the aforesaid Exposition.

It was thus that Mr. Albert Koebele, in the fall of 1888, was sent to Australia for this special purpose. The history of Mr. Koebele's efforts has been detailed from time to time in Government publications and in the press, especially that of California. It suffices to state that a number of living enemies, both parasitic and predaceous, were successfully imported, but that one of them, *Vedalia cardinalis*, proved so effective as to throw the others entirely into the shade and render their services really unnecessary. It has, so far, not been known to prey upon any other insect, and it breeds with surprising rapidity, occupying less than thirty days from the laying of the eggs until the adults again appear.

These facts account for its exceptionally rapid work, for in point of fact, within a year and a half of its first introduction, it had practically cleared off the Fluted Scale throughout the infested region. The expressions of two well-known people may be quoted here to illustrate the general verdict. Prof. W. A. Henry, Director of the Wisconsin Agriculture Experiment Station, who visited California in 1889, reported that the work of Vedalia was "the finest illustration possible of the value of the Department to give the people aid in time of distress. And the distress was very great indeed." Mr. William F. Channing, of Pasadena, son of the eminent Unitarian divine, wrote two years later:

> We owe to the Agricultural Department the rescue of our orange culture by the importation of the Australian ladybird, *Vedalia cardinalis*.
>
> The white scales were incrusting our orange trees with a hideous leprosy. They spread with wonderful rapidity and would have made citrus growth on the whole North American continent impossible within a few years. It took the Vedalia, where introduced, only a few weeks absolutely to clean out the white scale. The deliverance was more like a miracle than anything I have ever seen. In the spring of 1889 I had abandoned my young Washington navel orange trees as irrecoverable. Those same trees bore from two to three boxes of oranges apiece at the end of the season (or winter and spring of 1890). The consequence of the deliverance is that many hundreds of thousands of orange trees (navels almost exclusively) have been set out in southern California this last spring.

In other words, the victory over the scale was complete and will practically remain so. The history of the introduction of this pest, its spread for upwards of twenty years, and the discouragement which resulted, the numerous experiments which were made to overcome the insect, and its final reduction to unimportant numbers by means of an apparently insignificant little beetle imported for the purpose from Australia will always remain one of the most interesting stories in the records of practical entomology.

The Vedalia has since been successfully colonized at the Cape of Good Hope and in Egypt, and has produced the same results in each case. In Egypt the Vedalia was introduced to prey upon an allied species of Icerya (*I. ægyptiacum*, Douglas). We hope soon to be able to send the same insect to India, where it has recently transpired that *Icerya ægyptiacum* occurs, while recent information received from Phra Suriya, royal commissioner of Siam at Chicago, would indicate that its introduction into Siam for the same or a closely allied insect will be desirable in the near future.

In fact, the success of the experiment was so striking and so important, and resulted in the saving to California of an industry of so great a money value, that it has given rise, not only in the popular mind but in the minds of a certain class of entomologists also, to the idea that remedial work against injurious insects should be concentrated upon this one line of action, and that our best hope for their destruction lies with the parasitic and predaceous species, not to mention fungus and bacterial diseases. From an extreme of comparative incredulity the

farmer and fruit-grower have gone, perhaps, to the other extreme of too great faith. The case of Icerya and Vedalia, as I have frequently pointed out, was exceptional and one which can not easily be repeated.

One of the humorous phases of the Vedalia experiment is, that the wide newspaper circulation of the facts—not always most accurately set forth—has brought me communications from all parts of the world asking for supplies of the renowned little Ladybird for use against injurious insects of every kind and description, the inquiries being made, of course, under a misapprehension of the facts.

While this California experience thus affords one of the most striking illustrations of what may be accomplished under exceptional circumstances by the second method of utilizing beneficial insects, we can hardly expect to succeed in accomplishing much good in this direction without a full knowledge of all the ascertainable facts in the case and a due appreciation of the profounder laws of nature, and particularly of the interrelations of organisms. Year in and year out, with the conditions of life unchanged by man's actions, the relations between the plant-feeder and the predaceous and parasitic species of its own class remain substantially the same, whatever the fluctuations between them for any given year. This is a necessary result in the economy of nature; for the ascendancy of one or the other of the opposing forces involves a corresponding fluctuation on the decreasing side, and there is a necessary relation between the plant-feeder and its enemies, which, normally, must be to the slight advantage of the former and only exceptionally to the great advantage of the latter.

This law is recognized by all close students of nature, and has often been illustrated and insisted upon by entomologists in particular, as the most graphic exemplifications of it occur in insect life, in which fecundity is such that the balance is regained with marvelous rapidity, even after approximate annihilation of any particular species. But it is doubtful whether another equally logical deduction from the prevalence of this law has been sufficiently recognized by us, and this is, that our artificial insecticide methods have little or no effect upon the multiplication of an injurious species, except for the particular occasion which calls them forth, and that occasions often arise when it were wiser to refrain from the use of such insectides and to leave the field to the parasitic and predaceous forms.

It is generally when a particular injurious insect has reached the zenith of its increase and has accomplished its greatest harm that the farmer is led to bestir himself to suppress it, and yet it is equally true that it is just at this time that nature is about to relieve him in striking the balance by checks which are violent and effective in proportion to the exceptional increase of and consequent exceptional injury done by the injurious species. Now the insecticide method of routing this last, under such circumstances, too often involves, also, the destruction of the parasitic and predaceous species, and does more harm than

good. This is particularly true of those of our Coccidæ and Aphididæ and those of our Lepidopterous larvæ which have numerous natural enemies of their own class; and it not only emphasizes the importance of preventive measures, which we are all agreed to urge for other cogent reasons, and which do not to the same extent destroy the parasites, but it affords another explanation of the reason why the fight with insecticides must be kept up year after year, and has little cumulative value.

But the problem of the wise encouragement and employment of the natural enemies of injurious insects in their own class is yet more complicated. The general laws governing the interaction of organisms are such that we can only in very exceptional cases derive benefit by interference with them. The indigenous enemies of an indigenous phytophagous species will, *cæteris paribus*, be better qualified to keep it in check than some newly introduced competitor from a foreign country, and the peculiar circumstances must decide in each case the advisability of the introduction. The multiplication of the foreigner will too often involve the decrease of some indigene. If a certain phytophage is generally disastrous in one section and innocuous in another by virtue of some particular enemy it will be safe to transfer and encourage such enemy, and this is particularly true when the phytophage is a foreigner and has been brought over without the enemy which subdues it in its native home. Icerya had some enemies in California, presumably American, but they were not equal to the task of subduing it. Vedalia, in the Icerya's native home, Australia, was equal to the task and maintained the same superiority over all others when brought to America. The genus was new to the country and the species had exceptionally advantageous attributes. But there is very little to be hoped from the miscellaneous introduction of predaceous or parasitic insects for the suppression of a phytophage which they do not suppress in their native home or in the country from which they are brought.

The results of the introduction by Mr. A. D. Hopkins of *Clerus formicarius* to contend with the Scolytids which were ruining the West Virginia pines were doubtful, for the reason that indigenous species of the genus were already at work in America. Yet the experiment was safe and desirable, because the European Clerus is more active and more seemingly effective than our indigenes. The Gypsy Moth was evidently introduced into Massachusetts without its European natural enemies, and as in some parts of Europe it is often locally checked by such natural enemies, a great number of which are known, a proper study of them and the introduction of the most effective could result in no possible harm and might be productive of lasting good. Such a course was advised by me at a conference upon the subject held in the rooms of the State Board of Agriculture, Boston, March 4, 1891,* and in corre-

* INSECT LIFE, III, p. 369, ff.

spondence with the Secretary of the Board. In neither of these cases should we expect the predaceous or parasitic forms to subdue their hosts more effectually in America than they do in Europe, except in so far as they were relieved, in the introduction into America, of whatever enemies they possessed in their native home.

There are two other laws which it is worth while to consider in this connection. One is, that while a plant-feeder's natural enemies are apt to cause its excessive abundance to be followed by a corresponding decrease, yet this alternation of excessive abundance and excessive scarcity will often be produced irrespective of such natural checks. An injurious insect which has been on the destructive march for a period of years will often come to a sudden halt, and a period of relative, and sometimes complete, immunity from injury will follow. This may result from climatic conditions, but more often it is a consequence of disease, debility, and want of proper nutrition, which are necessary corollaries of undue multiplication. Frequently, therefore, it may be inaccurate and misleading to attribute the disappearance of a particular injurious species to some parasitic or predaceous species which has been let loose upon it, and nothing but the most accurate observation will determine the truth in such cases. The past year furnished a very graphic illustration in point. Throughout Virginia and West Virginia, where the spruce pines have for some years suffered so severely from the destructive work of *Dendroctonus frontalis*, not a single living specimen of the beetle has been found during the present year. This has been observed by every one who has investigated the subject, and particularly by several correspondents who have written to me; by Mr. E. A. Schwarz, who was commissioned to investigate the facts, and by Mr. Hopkins, who has made the study of the subject a specialty.

The clearest explanation of this sudden change is that the species was practically killed out by the exceptionally severe cold of last winter, since such was the case with several other insects. Now, following so closely on the introduction by Mr. Hopkins of *Clerus formicarius*, how easy it would have been to attribute the sudden decrease to the work of the introduced Clerus had not the decrease been so general and extensive as absolutely to preclude any such possibility. In like manner a certain Scale Insect (*Aspidiotus tenebricosus*) had become exceedingly destructive to the Soft Maples in the city of Washington last year, whereas the present year it is almost entirely killed off, evidently by the same exceptional cold. Many of the affected trees were painted with whitewash, with a view of destroying the Aspidiotus, and the death of this last might have been attributed to the treatment (and naturally would be by those employing it) were it not that the same result was equally noticeable on the trees not treated. Reports from southern California would indicate that the Red Scale (*Aspidiotus aurantii*) is, in many orchards, losing its destructiveness through agencies other than its insect enemies, and in this case the facts are particularly interesting because of the ease with which

its disappearance may be attributed to some of the recent introductions from Australia.

The other law that is worth considering in this connection is that experience has shown that, as a rule, the animals and plants of what is known as the "Old" World—*i. e.*, of Europe and Asia—when introduced into North America have shown a greater power of multiplication than the indigenous species, and in a large number of instances have taken the place of the native forms, which have not been able to compete with them in the struggle for existence. The converse proposition holds equally true, viz: that our species when taken to Europe do not hold their own against the European indegenes. This is still more true of the species introduced from the Old World, as well as from America, into Australia, where the advantage of the introduced forms, as compared with the indigenous, has been in many cases still more marked. All other things being equal, therefore, we should expect the species which are beneficial in Australia to be less so when brought to this country, a deduction which brings out still more clearly the exceptional nature of the case of Vedalia and Icerya, just as there are some notable exceptions, as in the case of the Grape Phylloxera, in the introductions between Europe and America.

There are some instances in which there can be no doubt whatever as to the good which would flow from the introduction of beneficial species, and an illustration is afforded in the Capri-fig insect, *Blastophaga psenes*. There can be no question as to the good which would result from the introduction of this species from Smyrna into those sections of California where the Smyrna fig is grown without its intervention, and there are other similar instances which promise well and involve no risk. But I have said enough to show that the successful utilization of beneficial insects is by no means a simple matter and that discriminating knowledge is required to insure success or prevent disaster, especially in the second category dealt with in this paper. The danger attending introductions of beneficial species by unconsciously accompanying them with injurious forms, or by failure to appreciate the facts here set forth, is well illustrated by the introduction to Europe of our *Peronospora viticola*, of the English Sparrow to America, and of the Mongoose to Jamaica. Wherever the importance of the matter leads to legislation, what are denominated "political" methods are apt either to control or in some way influence the resulting efforts—too often with unfortunate consequences. We should, as economic entomologists, be on the alert for special cases where the introduction or dissemination of beneficial species promises good results, and do our best to encourage an intelligent public appreciation of such special cases, while discouraging all that is of a sensational nature, as likely to mislead and ultimately do our profession more harm than good.

The paper was discussed by several members.

THE ECONOMIC VALUE OF PARASITES AND PREDACEOUS INSECTS.

By JOHN B. SMITH, Sc. D., *New Brunswick, N. J.*

At the very outset I wish to disclaim all intention either of producing a treatise on parasitism in general or disputing the importance of parasites in nature. No one can realize more than I do how much parasites maintain the balance and check the increase of injurious species. I am perfectly aware that were it not for parasites many an insect would become so abundant that certain crops could not be satisfactorily grown. Fully realizing, therefore, the place and importance of these parasites I feel at the same time that their economic value has been grossly overestimated; in fact I am almost ready to say that parasites have no real economic value to the agriculturist. This sounds like a very radical statement, and perhaps I do not mean it in the fullest sense of the terms that I have used; but I would not much modify the sense of the language. The "life history" of an insect is incomplete until we know not only how it lives and upon what it feeds, how it transforms, and the duration of its various stages, but also what species prey upon it, and to which it furnishes sustenance in one or the other of its stages. We are therefore right in our studies of the "life history" of injurious insects in studying also the parasites that prey upon them. We are right also in publishing the results of our work, including the descriptions of the parasites. We are right in calling the attention of the farmer to the fact that the injurious species are very largely kept in check by either parasites or by predaceous insects; but we are wrong in leading him to suppose that either parasites or predaceous insects will control the injurious species for him. Yet the tendency of the language used in many cases by entomologists, and more often by those who are not entomologists, has suggested the possibility that injurious species may be controlled by either parasites or natural enemies without very much work on the part of the farmer. The impression is current that it will be possible to use natural means to exterminate injurious insects, and I have been asked frequently during the past two years, by farmers that may be considered as fully equal in intelligence to the best in the land, those who read and usually understand, why I did not make some effort to cultivate or import parasites or natural enemies of our common injurious insects. Of course these questions all grow out of the remarkably successful experiment made by Dr. Riley in the importation of the Australian *Vedalia cardinalis* to exterminate the imported *Icerya purchasi*, and I have decided to bring up this subject for discussion at the present meeting in order that possibly a little more definite light can be obtained upon the exact place of parasites and predaceous insects in economic entomology. It needs no argument on my part to prove that nature

never creates organisms merely to destroy others that she had previously created. Parasites do not exterminate their hosts in any instance; their mission is merely to interpose a check to undue increase, and it is natural that this should be so, for were the host destroyed the parasite itself would perish, unless it were able to change its food and prey upon other species. It is by no means improbable that in the past certain species have been exterminated by their parasites, and, indeed, it is very probable that some such cases are in progress now. Many lepidopterous larvæ are rarely found free from parasites, and the adults are among the rarest of our species. Here we have instances where the parasite very materially lessens the number of the host and allows each year only a very few specimens to escape. It is only through the fecundity of the specie that it is enabled to maintain itself at all. These cases are exceptional. Usually the relation of the parasite to its host is more moderate. Excessive increase is checked, but excessive increase only. There is always a very large proportion of larvæ and usually a comparatively small proportion of parasites. Nature tends to preserve a balance among her creatures, and a balance only. Many species which are much subject to parasites are abundant each year, and remain equally abundant from year to year, varying only very slightly; and these variations are rarely the result of an excessive increase of parasites. Nature also works very slowly, and she adapts insects as well as other animals to their environment only by means that require ages for their completion. Insects that are confined to plants which, under natural conditions are not common, need few parasites to keep them in check. The great difficulty in finding food is in itself a sufficient check, and parasites are not necessary; indeed they could not be supported under the circumstances. If, by any unnatural condition introduced by man, the supply of food for this otherwise rare insect is suddenly increased, it obtains the possibility of multiplying rapidly, while the number of parasites does not increase proportionally. In the course of time nature may make a change and other species may attack this form which has now increased abnormally; but this is something that the farmer can not wait for; he must have some means of dealing with the insect at once, and he must leave the operations of nature to benefit his descendants. The spread and increase of the potato beetle, *Doryphora 10-lineata*, is a case in point. Here neither parasites nor natural enemies assist the farmer in any noticeable way. He must depend upon his own exertions to save his crop. There are, however, many insects which are very commonly parasitized, and among them may be mentioned the various species of cutworms. It is nothing uncommon to find in an infested field that fully one-half, and sometimes as many as three-quarters, of the specimens will have eggs of the Tachina flies attached to the skin and, probably, others have parasites which are not externally visible. Yet the fact that these cutworms are infested by para-

sites is of absolutely no value to the farmer. They eat just as much as if they were not parasitized, and it is really a matter of little importance to the agriculturist whether the food that is stolen from him makes a moth or a fly. The caterpillar feeds all the same until it is full grown. Next year in the same field there will be just as many cutworms as there were in the previous year. The parasites have kept the number within the same limit, and the farmer has not been benefited. If he desires to save his crop he must himself adopt measures for the destruction of these insects; parasites will not help him in the least. Let us take another instance: One of the species of Tortricids infesting the Cranberries is very subject to the attacks of parasites, two species being abundant, and a third rare; yet every year the bogs suffer equally from this species. If we collect a large lot of larvæ in the early spring we will find that very few of them will give out parasites. From the second brood we will breed a great many more, while of the third and last brood, probably 75 per cent will prove to be infested by parasites. This sounds very pretty, indeed, and we say that the insect has been controlled by its parasites, and so it has; but not until it has ravaged the bogs, and has done all the injury that it could do. It has destroyed the crop, and, seeing the enormous increase of the parasites during the year, the natural conclusion is, that they will next spring still further reduce the number of their host and bring matters to such a state that little or no further injury is to be apprehended. Yet, as a matter of fact, nothing of the kind occurs. We find that somehow during the winter the mortality among the parasites has been very much greater than it has been among the moths, and that just as in the previous year the first brood of moths will be almost exempt from the attacks of parasites. We will have on the bogs exactly the same history that we found in the previous year. Of what practical benefit is this parasite to the farmer? It does not do anything in the world to prevent the destruction of his crop, nor does it in any way lessen the damage, for where these insects occur and are allowed to increase without check, except by their natural enemies, they appear in sufficient numbers each year to take the entire crop. This is not a solitary instance. It can be matched with ease in all our common insects. The Codling Moth, for instance, has parasites, and is doubtlessly kept in some check by them; yet every one present knows that if parasites and natural enemies alone were depended upon, farmers could not count on a single perfect apple. They do check the excessive increase of the insect, but they do not lessen in the least the number that can be supported by the food plants. All the parasites that have been described from the Codling Moth, from the Plum Curculio, and any others of our injurious insects do not benefit the farmer one dollar in the value of his crops, and I think it is well that this should be generally understood, because of the tendency that I have already mentioned to expect too much from the parasites. It must be remembered also that in the opera-

tion of preserving the proper balance between life of all descriptions, nature itself has intervened to prevent the undue increase of the parasites, either by making them less fertile than the hosts upon which they prey, by giving them a smaller number of broods, or by supplying them in turn with parasites which keep them in check. This secondary parasitism is well known and it is as effective in preventing the excessive increase of the primary parasites as these are in preventing the excessive increase of the original host. There is really almost as much danger, and that is very little, that the secondary parasites will destroy the primary parasite as that the primaries will exterminate their host. Predaceous insects are in much the same case, they never entirely destroy the species they feed upon, and in 99 cases out of 100 they conquer their prey after all the injury has been done to the growing crops. Let us take the case of the Melon Louse for example. This makes its appearance in June or July, and increases with marvelous rapidity. Very soon after various species of Coccinellids make their appearance and begin preying upon the plant louse; but in the number in which they first appear they are incapable of eating up the lice as fast as they multiply. By September they are up with their prey, but then it is too late; the crop has been destroyed and, although it is quite probable that the late broods have entirely rid the vines of plant lice, yet it has not benefited the farmer one solitary cent. I had a beautiful opportunity of observing just this in 1892. It was a pleasure to see how the late broods moved from vine to vine, leaving scarcely a living louse behind them; but that same vine was dried and withered; whatever fruit there remained on it was undersized, blackened by honey-dew, half ripe, and never in fit condition for market. Acre after acre I have seen in just that condition, and practically no revenue has been derived from the land. It is quite true that the beetles exterminated or nearly exterminated the plant lice, but this did not advantage the farmer one solitary cent. A few buckets of kerosene emulsion liberally applied early in the season, while the plant lice were running away from the lady-birds, would have been of a great deal more money benefit than all the aid that nature gave. My contention is, that in dealing with injurious insects from the farmer's standpoint, we can entirely ignore the work of parasites or predaceous insects. We must accept the fact that each year these insects will appear in about the same numbers; that nature has evidently assumed that this is about the proper number to appear, and that all her checks are arranged accordingly. If we wish to lessen them, we must do it by means other than those which she has provided.

There is, of course, a possibility that we may in some cases make use of either parasites or predaceous insects. That has been very well illustrated by the instance before referred to, that of the Vedalia and the Icerya. The one point that is overlooked by the majority of those who see only newspaper accounts is, that we had to deal in the first

place with an insect which was not a native, but which was imported. In the second place the insect preying upon it was also imported, and found as the only familiar form upon which it has been used to feed just this one species. In bringing over the Vedalia its natural checks were not brought with it, and in liberating it in the orange groves of California it was given an advantage that it could never have possessed in its own country. There may be a few of our insects in a somewhat similar position, and possibly some one of us may yet be as successful as Dr. Riley was in reference to some other permanently injurious species. It may even be that parasites which in their native home are not able to control or exterminate the species upon which they prey may, when introduced into this country, have such an advantage that they will accomplish more than they could in their native home. I say this may be so, but I do not anticipate it in many cases. Insects are very slow to change their habits. Just as it is rare for an American parasite to attack an imported insect in any numbers, just so rarely will we be able to induce a European or other foreign parasite to attack the American insects. We have a field here which is comparatively new, and of which we know very little, but it is not that particular field that it is my intention to enter. The propositions that I do make, and that I am ready to defend are: Among our native insects parasites act merely as a check to excessive increase. Excessive increase means more than the natural food of the insect is able to support, and does not mean excessive increase in the sense of the farmer. An insect that is, under natural conditions, abundant each year must be dealt with without any regard to parasites or natural enemies. Other than I have just suggested, parasites and predaceous insects have absolutely no economic value.

The paper was discussed by several members.

The following paper was next read:

INSECT FOES OF AMERICAN CEREAL GRAINS, WITH MEASURES FOR THEIR PREVENTION OR DESTRUCTION.

By F. M. Webster, *Wooster, Ohio.*

The three principal cereal grains of America north of Mexico, viz, maize, wheat, and oats, cover an approximate area of from 140,000,000 to 150,000,000 acres. In other words, the natural flora over this vast territory, comprising a great variety of species, has been largely exterminated, and, instead, but three have been substituted, all of which are annuals with a capacity for reproducing each year from twenty to two thousand fold. As nature is said to abhor a vacuum, so does she resent a monopoly, except it be in cases where but few species can exist, and the increase of the individuals of these are ultimately restricted by

other influences, such as a rigorous climate or a barren soil. Our grain fields include neither the barren desert, the frozen mountain tops, nor the ice-clad regions of the far North, but the fertile prairies and valleys over which vegetation naturally grows in great luxuriance and profusion, each species if left to itself being kept in its proper numerical sphere by natural laws. The agriculturist, however, comes upon the scene and incites an insurrection, causing the three species before mentioned to not only rebel, but overrun and take possession of these broad acres, putting the original inhabitants to death and estab-

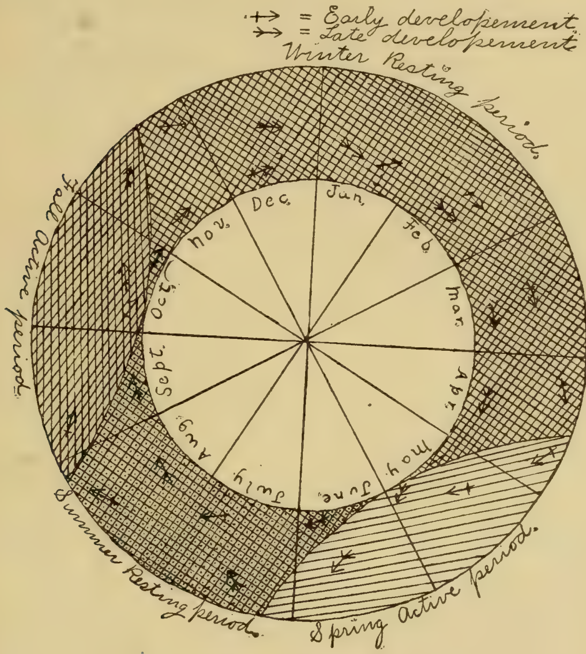


FIG. 2.—The annual cycle of the Hessian Fly (Webster del.).

lishing themselves in nearly or quite full power. If the contest were wholly a natural one, the interlopers would soon be forced into their proper places, and exist only in proportion as they could resist the returning encroachments of the natural flora. But the plow and the hoe again interpose, and the victors still hold the field. Nature then does what is naught but good generalship, brings up her reserves in the animal and vegetable enemies of the three usurping species and precipitates them upon the foe. It is here that the hand of the husbandman seems to lose its cunning. He can fight the forests, the

weeds, and the grasses, but when it comes to warring upon the insect and fungoid enemies of his grains he seems to lose heart. His reserve force is, or at least should be, in his superior knowledge; but too often this virtue seems to be either sadly aborted or entirely wanting. He does not study ways to destroy or circumvent these enemies of his crops, but, on the whole, allows them to go their way, patiently taking what they leave and hoping for better luck another year.

It is here that I wish to take up my subject and show how many of the insect foes may be either destroyed or prevented from inflicting serious injury. The field of applied entomology is not the science of killing insects, alone, but includes also the warding off of their attacks. For my own part I would reverse these terms, as it seems to me that the evasion of an attack is ordinarily the most important. I would put it in this way: Warding off the attacks of injurious species by preventing their breeding, and, in case this is not practical, destroying them either before or after the attack had begun. And I may be allowed to here make use of an oft-quoted adage, "An ounce of prevention is better than a pound of cure."

There are upwards of 140 species of insects affecting these three grain crops, and maize alone has over 100 insect foes, a number of course depredating alike upon all three. Of these, such as infest the stored grain excepted, there are very few whose attacks can not be far more easily warded off than remedied after they have begun. I know of no better insecticide than good farming. After eight years of study of the Hessian Fly (*Cecidomyia destructor*), I am satisfied that four-fifths of its injuries may be prevented by a better system of agriculture. For years I have seen wheat grown on one side of a division fence without the loss of a bushel by attack of this pest, while on the other side the crop was almost invariably more or less injured. No effect of climate, meteorological conditions, or natural enemies could have brought about such a contrast of results. The whole secret was in the management of the soil and the seeding. In fact, the question of success in evading the pest, in the one case, did not appear to be an entomological one at all; and I am fully convinced that the Hessian fly problem, so far as it relates to agriculture, throughout that portion of the country lying between the Alleghany Mountains and the Mississippi River, and between the Ohio River and the Great Lakes, may be considered practically solved. As applicable to this area, I have attempted to illustrate in Fig. 2, and also in Fig. 3, ideographically, the annual cycle of this insect, which can of course be only approximately correct for any single locality, there being a variation of nearly if not quite one month in the season of development between the northern and southern boundaries. It will be observed that there are four seasons in this cycle, two of activity and two of inactivity, or, we might term the latter resting seasons. Over this area the winter resting season is by far the longer, while the two active seasons are about equal. Toward the south I

believe the winter season will be found to be shorter and the summer season lengthened until they become equal, while to the north I confidently look for the autumn season of activity to wholly disappear and the species found to be single brooded. (See Fig. 3.)

Heretofore we have told people that the fly could not exist except where fall wheat was grown. But this can be said no longer, as the pest occurs in North Dakota and in a locality where fall wheat is never sown. As the fall brood of flies emerges continually earlier as we go northward, it seems to me that we must eventually reach a point where it will cease to appear in autumn at all, and go over until spring, a state of affairs that will easily account for the breeding in spring wheat

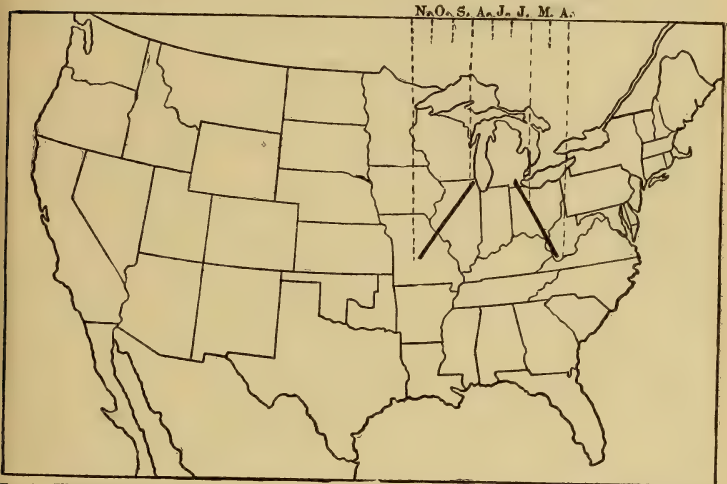


Fig. 3.—Illustrating the divergence of the two annual broods of the Hessian Fly with reference to date and latitude (Webster del.).

in North Dakota. In other words, I expect to find that nature has protected the species alike from the protracted northern winter, and the equally prolonged southern summer, by varying its resting season with the latitude, and, possibly, also with its proximity to the seacoast. That is, we shall find the insect passing both the hot and cold seasons largely in the flaxseed stage, that being the stage of development during which it is best protected from the elements and lack of food.

There are several good reasons why we might expect the fall brood to become extinct to the north, while the spring brood continues, the principal one being that there is not sufficient time for the former to develop before the cold season begins. Besides, in the continuity of the species it can best be spared, and I understand it is not present in England. In nearly all cases where a species is two-brooded, the spring-

appearing brood of adults is the producing while the fall is the diffusing brood. The spring-appearing flies are loth to leave the field in which they originated, and prefer to oviposit on the tillers of the wheat plant, while the autumn-appearing adults will spread out everywhere over the country, and will, seemingly, scent out a field of wheat at long distances. They can even be drawn to very small plots in the midst of large cities. With the Aphides the winged female produces fewer young, but spreads them over a larger area. In *Isosoma tritici* the spring brood of females has so far followed this rule in the past that their wings are either entirely absent or aborted, while the summer brood, *grande*, has invariably fully developed wings, and is the diffusing brood. The Army Worm, *Leucania unipuncta*, is destructive through one brood only, the fall brood being far less gregarious. This is also true of the Chinch Bug, *Blissus leucopterus*, though in northern Indiana and northern Ohio I find the larger part of the adults with aborted wings. The spring brood of Hessian Fly, coming as it does from plants that will continue through a sufficient season for their progeny to develop, has no need to migrate, while those that summer in the stubble must necessarily change, as the plants can furnish no further nourishment; besides, diffusion and differentiation serve, in a measure, to protect from natural enemies. But notwithstanding this, it will be easily observed that the later brood can be best dispensed with without material and permanent injury to the species. This appears to me to be a state of affairs that we may look for. I do not wish to be understood as making the unqualified statement that these conditions do exist, and only hope that members of this association, located to the north and to the south of the area indicated, will be able to prove either the truth or fallacy of my position. We have much yet to learn in regard to this Hessian fly, and a study of it in any locality would probably develop some new features, or at least new parasites.

There are some facts connected with the two species of Isosoma, *I. tritici* and *I. hordei*, that, to me at least, are rather puzzling. Unless an undetermined species, found in New York by Dr. Lintner, proves to be *tritici*, I am not aware of its occurring east of the Alleghany Mountains, though it reaches west to the Pacific coast. On the other hand I never saw *hordei* in Illinois or Indiana, nor did I find them in central Ohio, yet I had not been a week in the northern part of the latter State before I found them in abundance. They occur, generally, over the north portion of the State and into Michigan. Is it not possible that *hordei* is of northern origin, where the season is too short for two broods, while *tritici* has pushed up from the south, where the protracted vernal season is favorable for the development of two broods? I find that *hordei* almost invariably selects small wheat plants in which to oviposit, while the summer brood of *tritici* as invariably selects large, thrifty stalks, usually where the plants are thin on the ground but

rank growing. In northern Ohio I never find *hordei* far below the upper joint, an exceptional feature I believe, though it seems to me we might look for such a state of affairs, as it oviposits during a season intervening between the spring and summer broods of *tritici*. Then, too, I notice the parasites of *hordei*, at least *Eupelmus allynii* French, *Semiotellus chalcidiphagus* Walsh, and *Websterellus tritici* Ashmead, emerge in August and oviposit in the same straws from which they themselves emerged, the adults from these emerging in spring. I have also noted the same thing in the two former species where their host was the Hessian Fly. In both instances, however, I got fewer parasites in spring than in August.

So far as measures for their control are concerned, *tritici* can be largely overcome by a rotation of crop, while both this and *hordei* will be destroyed by burning the stubble, a measure equally applicable to the Hessian Fly and Wheat Stem-maggot, *Meromyza americana*. In

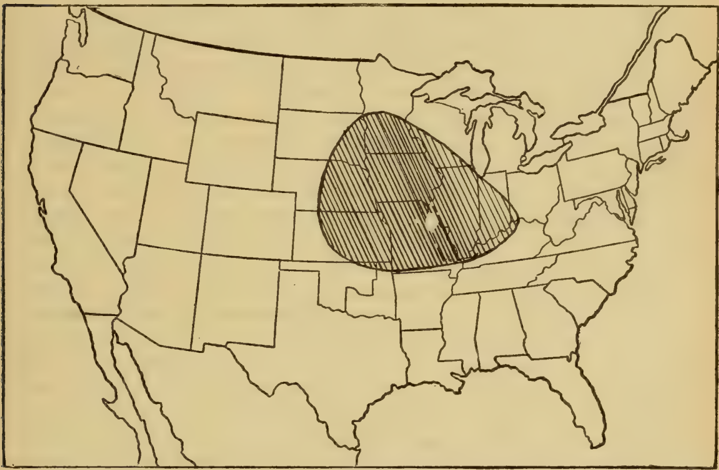


FIG. 4.—Showing area of continued serious ravages by Chinch Bugs. (Webster del.)

some portions of the country, however, clover is sown among the young wheat in early spring, and a burning over in summer under such conditions is impracticable.

I wish to call attention to a few points in reference to the Chinch Bug, *Blissus leucopterus*. The area of extreme continued injury by this pest covers southern Minnesota, southeast South Dakota, much of Nebraska and Kansas, all of Iowa, and much of Missouri, Illinois, all of Indiana except northeastern portion, extreme southwest Ohio, and northern Kentucky (Fig. 4), though in the wheat region of the Mississippi Valley the pest is by no means limited to this area, nor does it confine itself to the wheat region at all.

They are more abundant in Louisiana, where wheat is never cultivated, than they are in northern Ohio, where this cereal is one-half of the grain crop. When they were working their greatest havoc in southern and central Illinois and southwest Indiana I looked in vain for them in northern Indiana. I do not understand why it is that a very large per cent of the adults found in Ohio, along Lake Erie, and in northern Indiana possess only aborted wings; yet I have found this to be the case. As you all know, the insect parasites of this species are very few and of little account in holding it in check. For aid in this direction we must look to meteorological conditions unfavorable to their increase and the fungoid and bacterial parasites. These last will be found available during some seasons and within a certain limit, but nature is not likely to use one of her servants to annihilate another. We may be able to emphasize their work in this direction by continual artificial cultivation and distribution; further than this we can not expect to go, and the relief will at best be but local and temporary, though not by any means without value in limited areas. The only difficulty is in that we, with certainty, can not foretell a year of destructive abundance, and a few false alarms will so discourage the ordinary farmer that he will do nothing to protect himself. For my own part I feel quite sure that if the bugs can be induced to oviposit in spring in small plots of Millet or Hungarian grass they can be controlled by the use of these vegetal diseases to far better purpose than to attempt to do so in the fields of ordinary cultivation. But there must be, somewhere, a central source of supply where requests for material can be promptly filled, as has been done by Prof. Snow, before the plan will prove a success. Next in value to such plats is, I think, the cornfields where the young bugs must of necessity congregate in compact masses and thus facilitate contagion.

It would appear almost visionary to advocate spraying apple orchards in midwinter to protect the wheat crop, but nevertheless one of the most serious enemies of young fall wheat passes its egg stage on the twigs of the Apple during the winter season. I refer to the Apple Leaf-louse, *Aphis mali* Fab. Soon after the young wheat plants appear in the fall the winged viviparous females of this species flock to the fields and on these give birth to their young, which at once make their way to the roots, where they continue reproduction, sapping the life from the young plants. On very fertile soils this extraction of the sap from the roots has no very serious effect, but where the soil is not rich, and especially if the weather is dry, this constant drain of vitality soon begins to tell on the plants. Though they are seldom killed outright, these infested plants cease to grow, and later take on a sickly look, and not until the Aphis abandons them in autumn to return to the Apple, do they show any amount of vigor. It is very seldom that the affected plants fully recover, at least in autumn, and the result must be to reduce their productiveness the following year.

The greater number of serious pests of our fields of Indian corn are

such as work their injury below the surface of the ground. The larvæ of Elaters devastate our lowlands and the grubs of Lachnosterna ravage the higher lands, while Cutworms, Web Worms, and Corn Root-worms are found generally diffused over both. The Corn-Root-worm, *Diabrotica longicornis*, excepted, all of these seem more destructive to a crop of grain following a grass crop or pasture. Yet this is not always true. I have known of fields of corn being seriously affected by white grubs when such fields had not been devoted to grass for a single season in twenty years.

In the case of Wire Worms some good results may be secured by fall plowing, though as the adults emerge in August or September and winter over, also in this stage, we can hope to do little with these. There are, however, during the winter two younger generations in the soil, and against these a fall plowing may and evidently does have an ill effect. What a summer fallow would do I have had no opportunity of learning. There are no end of reported successes and failures among farmers, but there is so much obscurity shrouding these that one can not judge of their authenticity. Once, and once only, have I felt quite sure of having beaten these pests. This was in the case of a field of grass land, plowed in spring and planted with potatoes. The worms nearly ruined the crop, and in the fall the ground was still well populated with them. The following spring, potatoes that had escaped notice when the crop was harvested seemed to attract the worms, and the latter were found burrowing in the tubers in great numbers. On my suggestion, hogs were turned into the field, and these rooted out and promptly disposed of both potatoes and worms, no injury occurring to the following crop, which was of corn. There may be some virtue in the application of kainit, although this has not as yet been thoroughly and clearly demonstrated, and, besides, over the vast corn belt of the Northwest, its application is impracticable. For myself, I am willing to confess ignorance of any unfailing, practical measure, either of prevention or destruction. Fall plowing and a rapid rotation of crops are as yet the best measures we can recommend.

White Grubs, the larvæ of several of our species of Lachnosterna, appear to give preference to the higher lands. Where the soil of such lands is of such a nature as to wash easily during winter and spring, fall plowing results in the washing out of great gullies, thus constituting a grave objection to the measure. Outbreaks of this pest seem to be usually of triennial occurrence, different localities being affected during different years, and I have thought we might accomplish something by mapping out these areas, and so warn the agriculturist of their probable appearance. Here, however, the same trouble awaits us. A single mistaken prediction discourages the few who will follow our direction, and we get only derision from the remainder. In my own correspondence I have advocated the same measures against these as in case of the Wire Worms, viz, a rapid rotation of crops, especially of

grass or clover, and fall plowing, whenever it can be done without detriment to the fields. What has, or is likely to be accomplished by the use of fungoid parasites, I do not know. The opinion of our presiding officer, who is experimenting in that direction, will be of interest to us all. As in the case of the Corn Root-louse, *Aphis maidis* Fitch, or *Aphis maidi-radicis* Forbes, less injury is done in fields that have been fertilized with barnyard manure.

The Corn Root-worm, *Diabrotica longicornis* Say, has by its ravages cost the farmers of the Mississippi Valley millions of dollars during the last fifteen years, every penny of which might have been saved by a judicious system of husbandry. Every member of this association, located in the infested area, has again and again sounded the alarm and announced the remedy, yet I fear there are some who have not heard it. In Ohio it is unknown, except along the western border of the State. Its occurrence here, where it was reported last year for the first time, raises the question of its eastward diffusion—a problem which I hope to be able to solve. The congenor of this species, the Southern Corn Root worm, *Diabrotica 12-punctata* Oliv., will certainly not be managed so easily. There is yet some investigation to be done on this species, before we can confidently advise in regard to its destruction. It appears, in the adult stage, to be well-nigh omnivorous, and the larvæ travel freely.

The Corn or Boll Worm *Heliothis armiger* Hbn., is more especially a Southern species, though as far north as Chicago, there are during some seasons two broods, as, in that portion of Illinois, I have found half grown larvæ in the ears of ripe corn, in November. In the North the damage done is trivial, often being due to the rain and dew running into the affected ears, causing them to decay. Among the market gardeners, where it works in the sweet corn, the measure suggested by Prof. French, several years ago, which was late plowing in the fall, will do much to hold the species in check. In the South the most sensible and practical suggestion that I have seen mentioned is to plant corn early among the cotton in order to attract the early brood of worms, and then destroy the corn in a way to kill the depredators.

For the major portion of the cutworms, I have much faith in laying down of poisoned grass or clover baits, but the larvæ of *Hadena devastatrix* Brace and H. *stipata* Morris, can not be reached in this manner, as they do not come to the surface to feed. The first eats the plants directly off a short distance above the roots, while the last eats into the stem at about the same place, then tunnels its way upward, eating out the heart after the manner of the Stalk Borer, *Hydrœcia nitela* Gn.

I have here to introduce a third species of Hadena, *H. fractilinea* Grt., and an entirely new depredator in our cornfields, at least so far as published records are concerned. In fact we rarely find the species mentioned at all in our entomological literature. The imago was described in the *Canadian Entomologist* (vol. VI, p. 15, January, 1874),

the habitat there being given as Canada (Pettit), Albany, N. Y. (Lintner). Prof. G. H. French, who first determined the species for me, has it from Maine and New York, and Prof. John B. Smith has it from Maine to Ohio, Minnesota to Colorado. How far south it extends I do not know. The adults are so exceedingly quick in movement and secluded in habit that it is not surprising that it should be overlooked. Several specimens of both sexes that were transferred from the cage in which they were reared to another in which grass was growing were not observed afterwards.

The habits of the larvæ are in strange contrast with those of *stipata*, at least in the cornfields, where that species works entirely below ground, entering the stem just above the roots and eating its way upward, while in this species they climb up the plant and eat downward, devouring the whole interior of the stem down to a point where the *stipata* would begin. If the plant be a young one—that is only 2 or 3 inches in height—these larvæ will enter the cylinder formed by the youngest leaf, but if the plant be older and tougher they will eat downward along the edges, as shown in Fig. 5, until the tissue is more tender, when they will enter the stem and work downward. The time of oviposition I am unable to give. Larvæ, from two-thirds to quite full grown, were taken the last of June, when they were said by farmers to be disappearing. From these larvæ imagoes appeared, *in the insectary*, the last days of July and up to the 10th of August. I did not observe them, nor can I learn of their occurrence elsewhere than on spring-plowed grass land, and this either wholly or in part timothy sward. There appeared to be no difference in point of injury between early and late spring plowing. There did not appear to be any disposition on the part of the larvæ to wander about, but if the corn was planted in hills, after finishing one stalk they would abandon it and attack another, and so on until all were destroyed.

FIG. 5.—*Hadena fractilinea*; *a*, lava; *b*, pupa—nat. size. (Webster del.)

Description of the Larva. (Fig. 5, *a*).—Length 26^{mm}; color, yellowish white, two dark, broad, dorsal stripes separated by a narrower light stripe of the general color of the body, the dark stripes extending from the anal segment forward, unbroken,

to the first thoracic where there are one or two narrow sharply defined interruptions, also of the general color of the body and near the anterior margin of each of the thoracic segments, thereby dividing the dark stripes unequally, the anterior portion being little wider than the interruption. Cervical shield honey yellow, uniform in color with the head, but rather lighter than the anal shield. A rather narrower and darker lateral stripe extends from the head to the anal segment, its lower margin being on a line with the spiracles. At the posterior extremity of this lateral stripe, just above and slightly forward of the anal proleg is a round, dark-brown dot from which originates a short, hooked bristle; just beyond this dot and extending around the posterior margin of the anal segment to a corresponding point on the opposite side and just under the slightly projecting anal extremity is a continuous row of four connected dots of the same dark-brown color and each producing a short, curved bristle, all slightly curving upward. The head is small, rather less than the anal segment with the mouth parts well developed and very dark brown in color, being smaller than the first segment in about the same proportion as the anal segment decreases in size from the one that precedes it and the coloration and markings being so nearly alike, it is not an easy matter to distinguish the two at a glance. From the second to the ninth segment there is little variation in the size of the body, it being rather slender until near the time of pupation, when it increases somewhat in size anteriorly.

Description of the Pupa. (Fig. 5, *b.*)—Length 14^{mm}, greatest diameter 4.5^{mm}. There are no teeth or spines except at tip, where, extending from near the dorsal tip of the last segment are two horizontal, short, robust, blunt appendages, parallel, but flanked on each side by a very slender, hooked appendage, exceeding in length the former but of a lighter color. Just beneath these, on the ventral surface, is a short, deep slit, the edges and vicinity of which are very dark brown. The general color does not differ from that of other allied species.

The larvæ, from which all of my adults were reared, were taken from corn plants either in the field, or from plants sent me by my correspondents, and I saw every one of them in transferring them to the breeding cages. All were working in corn in precisely the same manner and there was certainly no noticeable difference in the larvæ. The imagoes, however, were those of two species, as they are now understood, the larger number being the one under consideration, while the remainder were *Hadena misera* Grt. If, therefore, the two species are distinct, then this also must be added to the list of corn-destroying insects, and a further study will be necessary to separate the larvæ, whose depredations appear not to differ. Prof. Smith writes me that he has this last species from Colorado, taken by Bruce, and also from Minnesota, bred by Prof. Lugger. All this, of course, does not disprove the validity of the species, as, if I remember rightly, there is a strong resemblance between the larvæ of *H. fractilinea* and *H. stipata*, as I observed them in corn in Indiana some years ago.

The various species of web worms, larvæ of several species of Crambus, are, of late, working nearly as much damage in our cornfields as are the cutworms, and are even less accessible. The larvæ of at least three species have this season devastated the cornfields of eastern Ohio, one of which appears to feed below ground exclusively. For my part, I am puzzled to know how to deal with these. Can it be done by breaking the sod in early summer, and allowing the wind and sun to

dry out and kill the grass roots, thus starving the very young worms? The plan of breaking the ground very late in spring and planting the crop immediately I find often fails of protection.

In conclusion, permit me to direct attention to the fact that the field of the economic entomologist is but poorly defined. To work out the life-history of a species and study its relations to other forms of life, learn what substances will destroy it, determine what course of procedure is calculated to prevent its breeding, would appear to constitute our true field of labor, but we are expected, by some sort of magical power, to transform ourselves into carpenters, mechanics, or civil engineers, and devise machines, methods, and all the details of application in a manner to fit the current notions of agriculturists.

Now, it seems to me that this is not necessarily all applied entomology. It belongs, it appears to me, equally as much to the science of applied agriculture, and I am in favor of giving the farmer the opportunity of putting his own shoulder to the wheel and exercising some of his own ingenuity to help himself. Outbreaks of injurious insects, like the diseases of the human system, are due to certain foregoing causes over which the entomologist has no control whatever, but when the trouble comes we are expected to go out and instantly stop it. You all know how impossible this is, and yet how difficult it is to make people understand the impossibility of it. I think that at present we are doing our whole duty and even more.

I congratulate the members of this association on the progress we are making. No nation on earth is or ever has made such rapid advances. We make some mistakes it is true; who that does anything at all does not? Honest errors are not only no disgrace but may be of value to those that follow after. We are profiting by the mistakes of Harris, Fitch, and Walsh; why may not those who shall carry the work forward after we are gone likewise profit by ours?

In discussion, Mr. Howard stated that *Isosoma tritici* occurs outside the limits Mr. Webster assigned it, since it has been found east of the Alleghanies. Further discussion was prevented by the necessity for adjourning for the boat ride on Lake Mendota.

Adjourned.

FOURTH SESSION—AUGUST 16.

The association met in room 24 and was called to order by the president at 9 a. m.

Mr. Summers moved that Mr. G. C. Davis be elected a member of the association. It was carried.

As chairman of the committee on the president's address Mr. Osborn reported as follows:

Your committee, to whom were referred the recommendations in the president's address, would report that they favor the adoption of such recommendations, and recommend the appointment of a standing committee to present a detailed plan for coöperative work among members, and to make recommendations concerning legislation.

HERBERT OSBORN, *Chairman.*
JOHN B. SMITH.
H. GARMAN.

The report was adopted, and Messrs. Osborn, Smith, and Garman were appointed as such committee.

The president at this point called Second Vice-president Smith to the chair, and the discussion of Mr. Webster's paper on grain insects was resumed.

Mr. Forbes remarked that it can not be inferred that the Hessian Fly is single brooded in a region where no winter grain is raised on the evidence of the absence of winter grain alone, since volunteer spring grain may give opportunity for the breeding of a second generation, and in this connection instanced an observation of his own in the spring-wheat region of northern Illinois where the fly is admittedly double-brooded, but where he found it infesting barley in spring.

In reply to questions Mr. Webster stated that a difference in the relative injury by Hessian Fly observed by him in two fields was due to the better condition in which the ground was kept in the case of one of them, so that wheat sown late enough to escape the fall attack grew rapidly and went into the winter in prime condition, while in the other field the wheat, if early sown, was infested, and, if sown late, was winter killed.

Mr. Webster stated in this connection that the fall brood of the fly scatters everywhere for oviposition, while the spring brood does not range widely, but is most likely to lay again on other plants (suckers, etc.) in the same field.

Mr. Riley asked Mr. Webster to give some account of the actual experiments and observations which had led him to make the statements in reference to the Apple Aphis (*Aphis mali*). He had for a number of years known that this species had a summer existence on various grasses, and had been very anxious to have Mr. Webster, while an agent of the Division of Entomology, follow the full annual cycle of development so far as the wheat plant was concerned.

Mr. Webster said that he felt that his experiments were sufficiently conclusive.

The following paper was then read:

FUMIGATION WITH BISULPHIDE OF CARBON FOR THE COMPLETE AND RAPID DESTRUCTION OF THE INSECTS WHICH ATTACK HERBARIUM SPECIMENS, FURS, WOOLENS, ETC.

By H. du Buysson, *Brout Vernet, France.*

The fumigating chest for use with bisulphide of carbon has been employed for many years in the preservation of unpoisoned herbaria, which would infallibly be devoured without this annual or biennial precaution. These fumigations may render great service in the preservation of other objects more useful than the specimens of a herbarium. I shall describe, therefore, the first method used, and every one will know how to apply it to his own needs.

DESCRIPTION OF THE FUMIGATING CHEST.

It is in principle a rectangular box of light wood, lined with thin zinc, which is carefully soldered at all joints. Around the edge of the box, inside, runs a little gutter of zinc, carefully soldered. This gutter is filled with water and serves to make a water séal by means of the flange of the lid, which is also covered with zinc and carries all around a strip of the metal bent at right angles, and long enough to plunge into the water in the gutter. In this way the box is hermetically sealed and the vapors of the bisulphide cannot possibly escape from it.

USE IN THE PRESERVATION OF HERBARIA.

Botanists now generally poison their specimens, and the fumigating box is seldom used. Nevertheless it has served me well and I still resort to it from time to time, to preserve such plants as I have not time to submit to the action of arsenic in alcohol or to bichloride of mercury.

The process in question is based upon the great volatility of bisulphide of carbon at ordinary pressure and moderate temperature. The penetration of its vapor is so considerable that we have only to pile up in the chest the mounting-sheets of the herbarium, one above the other, in order to fumigate them. They are penetrated to the very center and eggs, larvæ, and perfect insects, Anobium or Attagenus, are killed. Space should be left and right of the pile for the vessels containing the bisulphide. Those which I use are of zinc and measure 10cm. long, 6cm. wide, and 9cm. deep. There is no risk in prolonging the fumigation; on the contrary there is but the greater certainty of its being efficacious. Five or six days will be time enough. No limit need be set to the quan-

tity of bisulphide used; what is not evaporated will serve for a new charge.

The disagreeable odor of bisulphide of carbon is not persistent; it is not even necessary to spread open the mounting-sheets; it is only necessary to expose them, unopened, to the air. I would call attention, however, to one very necessary precaution, if accidents are to be avoided. The vapor of bisulphide is very inflammable, and the chest must, therefore, be set in a safe place and not opened near a fire or any flame whatever. It would be risky, for example, to unpack the chest in the evening while holding a lamp in the hand.

As the odor of bisulphide is very disagreeable and may cause discomfort to some persons, all these operations should be performed in an attic or in an apartment of which the windows may be left open as long as necessary.

PRESERVATION OF FURS AND WOOLENS.

The same process may be used in the preservation of clothing in clothing establishments, civil or military, where Tinea and Attagenus sometimes cause such ravages. Special arrangements may be adopted in establishing fumigating chests or rooms to avoid the settling due to weight and to facilitate the penetration of the gas.

This method makes it certain that we shall not "shut the wolf up in the sheepfold." Articles fumigated are entirely rid of eggs, larvæ, and living insects. They may be shaken out in the open air for greater security and then replaced on the shelves, with the assurance that they will not be found gnawed when next visited.

PRESERVATION OF THE STUFFING OF FURNITURE AND SADDLES.

Tinea and Attagenus have a marked predilection for horsehair, so that these insects are sometimes found flourishing in the stuffing of our furniture, even that which is in daily use. This process has the advantage of permitting us to destroy them without having recourse to the upholsterer; we need but to construct a fumigating chest large enough to contain a couple of armchairs or more. In the same way we may treat mattresses, eiderdown quilts, or anything which is supposed to contain eggs or larvæ.

I have experimented with a saddle much damaged by moths, and after fumigating it five days noticed no appearance of insects; the saddle was completely penetrated by the vapor and all the moths perished. I kept it two years under observation in order to be assured of the efficacy of the process.

DISINFECTION IN EPIDEMICS.

I am persuaded that clothing subjected to this process would be disinfected quite as well as by the processes usually employed in certain epidemics, such as typhus, cholera, smallpox, etc. It seems to me that

the vapors which penetrate fabrics so well and kill insects so thoroughly would act in the same way upon the microbes which engender epidemics.*

In discussing this paper Mr. Atkinson stated that he had used a very similar box in fumigating objects infested with insects.

Mr. Garman called attention to the fact that at the museum of comparative zoölogy at Cambridge a large upright zinc-lined case was constantly used for disinfecting the skins of birds and mammals.

Mr. Riley had used bisulphide of carbon successfully for his insect collections.

Mr. Smith had used it successfully for ants, and found it not injurious to vegetation.

Mr. Garman reported having found it effective in destroying the Melon Louse. His method of applying it was to roll the vines up in a heap, then invert a tub over them, and after placing a saucer containing a tablespoonful of the bisulphide under the tub its edges were pressed down into the soil or the earth was drawn up when necessary. He had tried the fumes of burning sulphur and tobacco, but the former injured the plants and the latter did not kill the plant lice, many of them gradually recovering after being stupefied by it.

Mr. Smith thought since the aphides often spread from particular plants or hills, the use of bisulphide in good season might make it possible to prevent the injuries of these insects.

Mr. Forbes, who had been prevented by his duties as presiding officer from taking part in the discussion on parasitism when this subject was before the association, was called on to give his views on this subject. The gist of his remarks was that parasites and hosts keep a pretty constant ratio to each other when in natural conditions. Under disturbed conditions he thought the practical view is that parasites are beneficial.

The following paper was then read:

APHELENCHUS OLESISTUS NOV. SPEC., A NEMATOID WORM, CAUSE OF A LEAF SICKNESS IN BEGONIA AND ASPLENIUM.

By DR. J. RITZEMA BOS, *Wageningen* (*Netherlands*).

(Read, in the author's absence, by G. F. Atkinson.)

In the report of the third annual meeting of the Association of Economic Entomologists (INSECT LIFE, Vol. IV, p. 31) Prof. G. F. Atkinson gives some information on a species of Aphelenchus, discovered by Dr. Byron D. Halstead in the leaves of sick plants of Chrysanthemum and Coleus. Prof. Atkinson says of the effects produced by this para-

---

* NOTE.—I have observed in bisulphide of carbon no clearly defined power of taking out the colors of fabrics which I have subjected to its vapor. It may, therefore, be used without fear, except, perhaps, in the case of the most delicate tints.

sitic worm: "It makes no swelling or deformity, as do many other Anguillulids, but causes a brown patch on the leaves." I have not before met a more ample description of this species.

I avail myself of the opportunity kindly offered to me to recommend to the attention of the members of the Association of Economic Entomologists a treatise of my hand, inserted in the recently published second number of the "Zeitschrift für Pflanzenkrankheiten," edited by Prof. Sorauer (vol. III, p. 69), a copy of which I took the liberty to send annexed to the secretary of the Association. In this treatise I describe a new species of Aphelenchus, which causes a disease in the leaves of Begonia and those of *Asplenium bulbiferum* and *A. diversifolium*, and which produces no hypertrophy or gallification, as do indeed all other nematoid worms living parasitically in plants, as far as I know them, but makes the affected parts die away immediately without any preceding deformity. My new nematoid worm causing the death of the tissues, I named it *Aphelenchus olesistus* (ὀλ—εο, radical of ὀλλύναι=to destroy; ἱστος=tissue).

For a minuter discription of the species I beg to refer to my treatise in the "Zeitschrift für Pflanzenkrankheiten" (III, p. 75–78). Still, I permit myself to state concisely the characteristics which distinguish my new species of Aphelenchus from the other well-known species of this genus. I have indeed some surmise that my new species is identical with the species meant by Prof. Atkinson in the above-mentioned information.

Firstly, I build my conjecture on the fact that both cause the decay of the parts of plants in which they live without causing gallification or hypertrophy as preceding symptoms, the more so, because all other kinds of Nematoids living parasitically in plants, as far as is known, give rise to the said deformity, and only after that, having strongly multiplied in the tissues, cause the death of the cells.

Secondly, I observe that the Aphelenchus of Prof. Atkinson, as well as mine, can live in very unlike species of plants, but that both were till now discovered in pot plants only.

In order to contribute to a decision, if possible, whether the Aphelenchus of Prof. Atkinson be or be not identical with my *Aphelenchus olesistus*, I give here a very concise description of the latter.

Description.—Length of the males, varying between 0.51 and 0.62 mm. (average, 0.58 mm.); that of the females, varying between 0.55 and 0.81 mm. (average, 0.68 mm.).

The proportion of the length to the greatest breadth of the body lies between $\frac{30}{1}$ and $\frac{53}{1}$.

The proportion of the length of the body to that of the œsophagus ranges between $\frac{12}{1}$ and $\frac{9}{1}$.

The spear is very delicate and small, becoming thicker to the back part and without ending in a knob.

The vulva lies at about one-third of the length of the body from the hindmost extremity of the body. The ovaria are double; one of them is found before, the other behind the vulva; the latter ovary is the shorter of the two.

Spicula of the male slightly bent, length, 0.009^{mm}.; accessory part very small.

In discussing this paper Mr. Atkinson remarked that, while there were characters present in the species he had described that seemed to place it in the genus Tylenchus, he had been of the opinion from the first that his species was introduced into the United States, and would not be surprised if it should prove, on more careful examination and comparison with the one described in the paper just read, to be identical with the latter.

The following paper was then read:

METHODS OF ATTACKING PARASITES OF DOMESTIC ANIMALS.

By Herbert Osborn, *Ames, Iowa.*

In dealing with insect parasites of domestic animals we need to consider, first, the method of attack of these parasites, and we may conveniently separate them into the external parasites and the internal parasites. Among the former we have various species of lice, itch-mites, ticks, and can also include those forms which affect the external parts of the body by depositing eggs in sores. In the latter series we may include the different kinds of bot flies affecting the internal organs and certain forms of degraded Acarina which also affect certain internal organs. It is unnecessary here to detail the mode of attack of the external forms more than to mention that some pierce the skin to suck the blood, others simply feed upon external excretions of waste material, while others may burrow beneath the epidermis, producing pustules, scabs, etc.

First among the methods of treatment we should consider that of prevention, since, for perhaps the majority of the parasitic forms, a little effort in the direction of prevention is far more effective than costly and laborious methods later on.

With a large majority of parasitic species, including all of the lice, the sheep-infesting Hippoboscidæ and all of the Sarcoptidæ, infection results from the mingling of parasitized animals with those which are free from parasites. It is therefore possible by attention to animals introduced into a herd, or sometimes into a new section of country, to prevent entirely the introduction of the parasites. To accomplish this it is necessary to examine introduced animals, and if infested, or suspected of being infested, use thorough treatment upon these. In the case of introduced cattle infested with Hypoderma it would seem possible that they might, by being carefully watched and the grubs destroyed, be prevented from introducing this pest in any new locality. Since the parasite occurs only in the bodies of cattle during the winter season, I see no reason why attention to imported cattle should not serve to totally exclude this pest from any locality which has hitherto been free from it. The bots in horses may be pre-

vented by the well-known method of shaving off the eggs, so as to prevent the introduction of the larvæ into the mouths, while for the bot fly affecting the sheep I am not aware of any more effective plan of prevention than that of applying tar to the noses of the sheep. For direct treatment, the methods for external parasites may be grouped under the head of washes, powders, and fumigation. The use of washes in the treatment of parasites is perhaps one of the oldest methods. The modifications consist in the methods of applying or in the materials used as a wash. The method of application will depend somewhat upon circumstances, but should aim to reach all parts of the body, and particularly those parts most infested. Sponging the animal with a cloth or sponge dipped in the insecticide material and application by means of force pump in certain cases, particularly for hogs and thin-haired animals, is practicable in certain forms. A device recently presented by Dr. Francis, of Texas,* provides for the pressure by means of gravity, the barrel being elevated on a derrick and connected by hose with several nozzles directed downward, and a movable one to use in spraying the under parts of the body, the liquid being collected from a drip platform in a receptacle below. The liquid, however, is elevated by a pump, and while it may lessen the number of men necessary in spraying, the same end can easily be accomplished where a force pump is at hand, if it is connected with several nozzles adjusted so as to play at proper angles on the animal. Dipping is probably the most speedy and effective method to use on a large scale, and especially for thick-haired or woolly animals, and for this purpose receptacles ranging all the way from a small tank for the treatment of a single animal at a time up to a large tank, including two or three dozen sheep at once, may be used. The ingredients for these washes have consisted mainly of tobacco, sulphur, lime, tar, kerosene, and arsenic, and each of these materials will be found to have its advocates.

Special formulæ for their combinations have been published in abundance, and need not be repeated here. Aside from these published formulæ there are different preparations on the market, some of which are doubtless valuable, and if the item of expense is considered satisfactory, it is perhaps proper to recommend their use. Kerosene emulsion has been used with success by Prof. Gillette† on cattle and hogs, and by Dr. Orcutt and Mr. Aldrich‡ for sheep dip, but Prof. Francis pronounces it less satisfactory than some of the proprietary combinations for ticks on cattle. I have also seen some reports of poor success with it or apparent injury, especially to lambs, from its use.

While I fully believe in its efficiency when properly made and applied and would attribute failures to improper preparation, the fact

---

* Bulletin Texas Ag. Exp. Sta., No. 24, p. 256.

† South Dakota Exp. Sta. Bulletin No. 30, pp. 16, 17.

‡ Iowa Exp. Sta. Bulletin No. 11, p. 495.

that such failures occur in practice is somewhat unfavorable to the general adoption of this remedy.

The various powders used are tobacco, sulphur, pyrethrum, snuff, and common road dust (the latter presumedly acting by closure of the spiracles), and of the other substances, tobacco or preparations including this material may probably be considered as most generally useful.

Pyrethrum, if dusted in among the hairs so as to thoroughly reach the insects when first applied, is quite effective and may be used for fleas and lice, but probably would not affect the mites.

Fumigation is a method which presents some advantages where it is practicable, because it can be used during winter, when washes are objectionable and is preferable to powders, because all of the individuals affecting an animal may be killed and thus entirely free it, whereas by the other method the survival of a few individuals may restock the animal. A simple plan of adopting this is to cover the animal with a blanket, leaving the eyes and nose exposed, but having the blanket reach the floor or ground and made as tight as possible at all points to prevent the escape of fumes. Puff tobacco smoke under this blanket by means of a bee-smoker. This plan first came to my notice as recommended by Mr. Charles Aldrich, who claims for it very effective work. I have also seen a description of a plan for fumigation of fowls which involves the same principles. Some years ago* I suggested the plan of using a tight stall, with an opening for the head, a canvas protection, so as to leave the head, eyes, and nose exposed and free; and some experiments with this method showed that fumes of either sulphur or tobacco are very effective in destroying lice, both the Pediculidæ and Mallophagidæ. The time of exposure to the fumes varied from twenty to twenty-five minutes in these experiments. The sulphur or tobacco were burned over an alcohol flame, but I should presume a preferable plan would be to place the substance in a tin or sheet-iron tube, closed at one end, with the open end projecting into the stall, and drive the fumes off by means of heat applied to the under surface. The common little lamp-stove could be used. The stall should be made as small as possible to accommodate the animal, in order that the fumes may be as dense as possible, and on this account the simple covering with a blanket is perhaps preferable, as it adjusts itself to the animal, but provision should be made for the free circulation of fumes on the parts of the animal where the blanket would press.

Feeding of sulphur with salt is strongly recommended by some, and Prof. Weed, of Mississippi Station, gives it a strong indorsement as a result of experiments at that station directed especially against the cattle tick (*Ixodes bovis* Riley).

---

* Bulletin Iowa Ag. College, Dept. Entomology, 1884, p. 78.

Mr. Gillette asked how the hen louse could be destroyed.

Mr. Osborn, in reply, said he thought the use of tar on the ends of the poles in the henhouse could be made to answer this purpose.

Mr. Aldrich thought it not safe to recommend the use of kerosene oil for destroying insects on animals, because of the injurious effect on the skins of the host.

Mr. Gillette replied that he agreed that kerosene should not be used for sheep, but for hogs and cattle it was useful.

Mr. Riley remarked that he was deeply interested in the change of opinion resulting from later experience and experiments regarding the usefulness of the kerosene emulsion in destroying animal parasites, and particularly in Mr. Gillette's altered experience in reference to its use on sheep. He thought, however, that the difficulties of making a good kerosene emulsion and of getting intelligent farmers to use it safely were unnecessarily magnified. He could not accept the doctrine that of two given remedies the poorer one was to be recommended because the better required a little more care and intelligence in making and using.

Mr. Hopkins had used sulphur for stock at all times and found it not injurious.

Mr. Weed reported that sulphur and salt mixed were fed to stock in Mississippi for ticks. Some thought it ineffective. But it was tried at the station and found to be a complete remedy. It had been claimed that sulphur used during wet weather was injurious, but this was tried and found not to be true. Sulphur had been supposed to cause a decrease in the quantity of milk, but careful experiments at the Mississippi Station had shown this to be untrue. The sulphur and salt should be kept in use constantly. Ticks, he thought, infested by preference animals in poor health, and the chief good done by feeding sulphur and salt was keeping up the health of stock by destroying internal parasites.

Mr. Gillette inquired if the real bedbug ever occurred in hen houses. A case occurred in Iowa where bugs, which appeared to be the same as that found in dwellings, were abundant.

Mr. Howard remarked that Townsend, of New Mexico, had recently discovered another species (*Cimex inodora* Dugés) in henhouses.

Mr. Osborn thought the characters of the form occurring in henhouses might be considered either varietal or specific.

The following paper was then read:

REMEDIES FOR INSECTS INJURIOUS TO COTTON.

By HOWARD EVARTS WEED, *Agricultural College, Mississippi.*

There are but two species of insects which are especially injurious to cotton—the Cotton Leaf-worm, *Aletia argillacea*, and the Cotton Boll-worm, *Heliothis armiger*. While there are several other Lepidopterous species, especially *Arctia rectilinea*,* which occasionally may do considerable damage, and many Hemipterous species, which do a certain amount of damage each year, these do not demand the attention which the Cotton Leaf-worm and the Cotton Boll-worm should receive. The object of the present paper is to present the latest, and what I consider the most effective, methods of dealing with the two last-named species.

THE COTTON LEAF-WORM.

Owing to the amount of injury caused by the Cotton Leaf-worm and consequent great financial loss to the cotton planters of the Southern States, this species was one of the first to receive attention at the hands of the U. S. Entomological Commission. We cannot but admire the admirable work done by this Commission in the investigation of the habits, life history, and remedies for Aletia, but the past ten years have made a great difference in economic entomology, so that the same remedies recommended by the Commission may not be the best to-day. In ante-bellum days, before applied entomology came to the rescue of the southern cotton planters, little or nothing was done in trying to destroy the Aletia in years when the species was abundant. In such years the cotton crop suffered an immense loss. Some planters, however, tried primitive means for the destruction of the Aletia, such as the picking of the worms by hand. Lights were also used by many, both for the Aletia and Heliothis. Lights are yet used in some localities very largely, but most planters have now abandoned the light method, as it has been many times pointed out by entomologists and others that the lights in the cotton fields do more damage in destroying beneficial insects than they do good in destroying the injurious forms.

Paris green is the insecticide mostly used in destroying the Aletia, although some few planters use London purple. It is applied by means of a simple apparatus which, for want of a better name may be designated as the "Cotton Dry-poison Duster." This duster consists simply of a pole six feet long, at each end of which is attached an osnaburg bag about a foot long and six inches wide. The pole is generally made of hickory and the bags are tacked onto the ends. A small

*NOTE.—At the Rochester meeting of the Association of Economic Entomologists (INSECT LIFE vol. v, p. 111) I reported this species as *Arctia phyllira*, but Dr. Riley afterwards identified it for me as above.

hole is made through the pole near each end, the holes being stopped with plugs either of wood or cork. These holes open into the bags, and through them the bags are filled with the insecticide used. This distributor is generally operated by a darkey on a mule and going at a brisk trot, the vibration being sufficient to shake the insecticide from the bags and distributing it very well. This duster can be rigged up at very little trouble and expense, and forms the most simple apparatus for the distribution of dry poisons that I have yet seen. It is needless to say that it can be used to apply dry insecticides to plants other than cotton. Used in the cotton fields four rows are treated at a time, the bags at each end of the pole being held over the space between the rows. At first thought one might think that in this way much of the insecticide would be wasted by falling upon the ground between the rows; but such is not the case, for when the cotton is nearly full grown it so completely covers the ground that there is little waste.

Another apparatus used in the cotton fields for the distribution of dry Paris green is the Roach poison distributor, manufactured by J. P. Roach, Vicksburg, Miss. This machine is used upon many large plantations, but most planters use the above-mentioned cotton dry poison duster, as it is so cheap and easily operated. The Roach distributor sells at about $60, putting it out of the reach of the average cotton-grower. When the Roach distributor is used the Paris green is diluted with about ten parts flour or lime, while in using the cotton dry poison duster preference is given to undiluted Paris green. About 10 acres can be gone over in a day with the cotton dry poison duster and about 30 acres when the Roach distributor is used.

While the Aletia could be destroyed by many insecticides other than Paris green or London purple, yet these are the best for this purpose, and these are much more easily applied in the dry form than when mixed with water. Insecticides mixed with water do very well on a small scale, but when several acres are to be gone over dry insecticides are to be preferred, owing to the difficulty of getting the water in the field and the added trouble of hauling it about.

THE COTTON BOLL-WORM.

The remedies for the Cotton Boll-worm are far less satisfactory than the remedies for the Cotton Leaf-worm; for the former, owing to its working within the boll, cannot well be reached from the outside by the application of insecticides. The first brood of Boll Worms is produced upon corn soon after it is up, where it is known as the "Bud Worm." Here it often does considerable damage, and when the corn becomes older and the leaves unfold, it readily shows where the worms have been at work. The second brood attacks tomatoes, and between the worms and the tomato rot in some years it is impossible to raise a crop. I am inclined to think that the worms get the credit of destroy-

ing many tomatoes where the cause is really due to the tomato rot. The worms are much more apt to attack tomatoes slightly affected with the rot than sound tomatoes.

There are always some Boll Worms every year, but in some years there are but a few, while in other years they are very abundant. Scarcity or abundance, however, in one locality does not necessarily mean a like condition in another locality. Thus at the Mississippi Agricultural College last year, especially toward the close of the season, the Boll Worms were very abundant, but this year there are scarcely any, while at Columbus, 25 miles distant, they are reported this year in great abundance.

As the Boll Worm works *within* rather than *without*, I doubt very much the practicability of the application of any insecticide to destroy them. Success in this direction would be more apt to follow with the Boll Worm upon tomatoes than upon cotton. Upon tomatoes the insecticides would have to be applied to all parts of the fruit, the underside as well, and it would also have to be applied several times during a short growing season. With cotton the bolls are somewhat concealed and the eggs are deposited at the calyx or underneath, where it would be difficult to place an insecticide. So that so far as our present knowledge goes we may say that the application of insecticides for the Boll Worm is impracticable.

Much has been done in the way of poisoned sweets, but with little success. Lights, as already stated, do more harm than good. Fall plowing has been recommended and no doubt would do much good, especially if the ground was well broken several times during the winter if the weather would permit. Farmers say as to this, however, that fall plowing was universally practiced in ante-bellum days, yet the Boll Worms were then if anything more numerous than at present.

The only effectual way of dealing with the Boll Worm is by means of trap plants, *i. e.*, by planting other food plants in the cotton fields upon which the Boll Worm will feed in preference to the cotton. I consider corn more effective for this purpose than cow peas or other plants. The Boll Worm attacks corn when first up and also when the ears are forming. I consider the best plan that of planting a row of corn about every tenth row throughout the cotton. The corn may be planted at the same time as the cotton, or better a little later, so that it will mature early in September. Some may say that this forms a good food plant for the Boll Worms and favors rather than decreases their numbers. Success in this trapping lies in the fact that the worms feed upon each other, and where there are several within an ear of corn it becomes a struggle for life in which the strongest survive. They thus destroy themselves, and besides this birds, especially sap-suckers and blue jays, also destroy great numbers. Parasites also are more apt to reach maturity when this plan is followed. Mally and others have recommended three plantings of corn in the cotton fields at different times

and then either destroy the worms by hand or gather and feed the corn while the worms are still within the ears. Very few cotton-growers would adopt this method of three plantings, as they would regard it as too much trouble. Planting trap rows but once, however, and having to do nothing to them but to cultivate along with the cotton, will be and is practiced quite largely. If this was practiced still more extensively we would not hear so much complaint about loss through damage by the Boll Worm.

Mr. Webster thought the chief difficulty in improving methods at the South was due to the ignorance and incompetence of the colored help.

The following paper was then read:

THE CHEESE OR MEAT SKIPPER.

(*Piophila casei.*)

By MARY E. MURTFELDT, *Kirkwood, Mo.*

In dealing with the insects detrimental to agriculture the entomol. ogist encounters no obstruction in the reluctance of the farmer to have his losses made known. With the pessimism characteristic of the profession, the latter is inclined to exaggerate rather than to make light of his difficulties and losses, and therefore gives the fullest publicity to any agency from which he suffers; but in the investigation of the habits and economic relations of an insect injurious to manufactured products the case is very different. The prudent manufacturer or merchant is very careful not to give to the public any fact which might arouse suspicion concerning the quality or durability of his products or wares. In the case of manufacturers such caution is especially necessary, as the tide of trade is so easily turned, and there are so many rivals in the field eager to take advantage of the smallest fact to the prejudice of a competitor. As an instance of this, one of our shoe manufacturers in St. Louis found, some years ago, that his stock was being injured by the Leather Beetle (*Dermestes vulpinus* Fabr). In his desire for a remedy he very appropriately applied to Dr. Riley, of Washington, who instituted an investigation as to the nature of the depredator and the means for eliminating it. I had the honor to assist in these studies, and I well remember the change of manner in the proprietor of the concern between the first visits to his establishment and those made later. At first every facility for observation was granted, and all questions fully and obligingly answered; but subsequent visits were somewhat coldly received and very little information could be elicited, and there was a general air of desiring to ignore the whole matter. This was explained sometime afterward, when a part-

ner in a rival firm chanced to mention that his business had profited considerably by the publication that So-and-so's shoes were "wormy"; and the latter declared that the attention which the "bug-hunters" had drawn to the matter "had damaged his trade to the extent of several thousand dollars." Such experiences inculcate caution in mercantile circles, and through this the entomologist undoubtedly loses many an interesting subject for study. Perhaps this might be amended if it was understood that names would not be published without permission.

In the case of the insect upon which I beg here to offer a few notes, no household pest is, perhaps, better known. The manufacturer, the grocer, and the housekeeper have each a considerable share in the loss which it occasions. For ages it has been the chief enemy of the cheese-maker, the best and richest of his products being most liable to its attacks. It does not, however, confine its ravages to cheese, but within comparatively recent years has become known as an equally, or rather far more, formidable destroyer of cured meats, causing the loss of thousands of dollars worth of property annually, and necessitating the expenditure of other thousands in labor and mechanical contrivances to keep it in check.

Although of European origin it has spread to all parts of North America, where it probably does tenfold the damage that it does in its native country. In view of these facts, and considering the hundreds of articles that have been published upon insects of no greater economic importance, it is really surprising that the American records of this pest should be so few and so brief. Before entering upon an investigation of its habits I made a search for the literature of the subject only to find that it had received but slight attention from our entomologists, from either a scientific or an economic standpoint. The only notes relating to it that are to be found in the annals of American Economic Entomology are the following:

In the *American Entomologist* (vol. II), published in 1870, is a copy of an article by X. A. Willard, giving a somewhat elaborate account of the destructiveness of the insect as a "cheese fly," with various recommendations of measures to be taken in factories and storerooms to preserve the products from its attacks. Appended to this is an editorial note giving an outline of its life history, with the statement that, so far as was then known, it was exclusively a cheese pest. In volume III of the same periodical, published in 1880, Dr. Riley briefly discusses it as an enemy of cured meats, here asserting its identity with the cheese fly. Dr. Packard, in his Guide, gives in a few lines its principal characteristics and refers to an observation of Prof. Putnam concerning the method by which it "skips." In volume IV of *Pysche* I remember to have seen something on the subject, but can not at present lay my hands upon the number containing it. In the report of the Entomological Society of Ontario for 1884 is also a brief paragraph of description

of it as a cheese pest. Not doubting that there were other works not in my library, in which it was more fully discussed, I applied to Dr. Williston, as our leading dipterologist, who very kindly answered:

> I, also, have had occasion to search for the life history of *Piophila casei* without success. I supposed there would be no difficulty in finding a full description of its habits, but was surprised to find no, or very meager, references in any literature at my command. * * * If you have studied its habits you will do a service by publishing them, even though it may happen that they have already been published, which I doubt.

Dr. Riley, however, informs me that the literature of the insect is sufficiently extensive though scattered, and that several European writers, and especially H. F. Kessler, have within recent years given careful accounts of its development and life history.

As it was my desire to bring the matter to the attention of the economic entomologists at the present meeting, I did not have time to obtain transcriptions from the authorities to which Dr. Riley refers, and so will offer here a popular synopsis of my personal observations, in which I am conscious there are some gaps and uncertainties. Those desiring a more minute and technical account can consult the works named by Dr. Riley.

My attention was directed to this pest about a year ago by an employé of one of the largest packing and curing establishments in the West, who wrote: "We wish to know what it is, and especially at what period in its life it can best be fought. It entails an enormous loss upon all our packing-house companies." Upon my request specimens of the infested meat were kindly sent me, and Mr. D——, my correspondent, gave me much valuable information concerning its work in the packing house.

The packages of ham and shoulder were received during the month of August, 1892, and consequently represented the worst work of the insect for the season. Swarms of flies escaped from the boxes as they were opened and myriads of "skippers" and puparia in all stages of development were disclosed, clustering around the bony ends, among the tendons, and in the softer fat and oil-saturated folds of the canvas wrappers. The lean meat was never in any case penetrated, although eggs and small skippers were abundant on the surface; nor was the solid fat much damaged. The methods of curing these meats had been so perfect, that even after an exposure of two or three weeks in an open shed to the August heats, upon cutting into the center of a ham and the thickest part of shoulder they were found to be perfectly sound and sweet. In justice to the "skippers," too, I must say that their work does not induce putrescence or ill odors, and although the spectacle of a ham swarming, externally, with the various forms of the insect is the reverse of appetizing, yet a large part of it is still edible and, the outside carefully removed, would be available for potted meats and similar preparations. But, of course, in the original shape it is absolutely unsalable; hence the loss.

The life history of the insect, so far as I have been able to trace it, is as follows, popularly presented: It hibernates in the perfect state, hiding, like the house fly, in cracks and crevices of the buildings which it frequents and behind furniture and machinery. The flies become active only when warm weather sets in. According to my informant they are first noticed, in the curing establishments, around the vats of "yellow wash" which is composed of glue, rye flour, and coloring matter, possibly attracted by the odor of the glue. If not rigidly excluded they follow the pieces of canvased and yellow-washed meat to the storerooms and deposit their eggs upon the wrappers, preferably among the folds, if they can find an opening that will admit them, otherwise upon spots where the fat has penetrated and loosened the wash. It has been difficult to ascertain the exact number of eggs laid by a single fly, as they are deposited not only in more or less compact clusters of from five to fifteen, but are also scattered singly. In the observation jars the average was about thirty, but it is possible that in these jars, confined upon small bits of meat and subject to much disturbance, the conditions were not normal and the number of eggs may, in consequence, have been reduced. Those of an individual seemed to be all deposited about the same time, in the course of an hour or less, soon after which the insect perishes. The egg is pearly-white, slender oblong, slightly curved, 1^{mm} in length, with a diameter about one-fourth the length. Hatching takes place within thirty-six hours and, leaving a filmy pellicle behind, the minute, translucent-white larva moves with wonderful activity in the direction of the food supply. Except in increase in size it does not change much in its characteristics. It is cylindrical, tapering gradually toward the anterior end, and is truncate posteriorly, furnished at this extremity with two horny, projecting stigmata and a pair of fleshy filaments.

There is no variation in the white color except in the retracted mouth-hooks which show a shade of dark gray. Dr. Packard, in his Guide, quotes from an observation of Prof. Putnam regarding the leaping power of the insect—

> When about to leap, the larva brings the under side of the abdomen toward the head while lying on its side, and reaching forward with its head and at the same time extending its mouth hooks, grapples by means of them with the hinder edge of the truncature and pulling hard, suddenly withdraws them, jerking itself to a distance of 4 or 5 inches.

To my knowledge the distance to which it "skips" is often much greater. I think the "skipping" a latent power in the insect as a meat pest, as there is no occasion to exercise it by the majority of the individuals. When breeding in cheese it would be necessary in many cases to escape by this means to some place in which it could transform in safety, but on the canvased packages of ham and bacon, the folds of the wrapper afford the most desirable of hiding places. It completes its growth in seven to eight days, attaining a length of from 7 to 9^{mm}

with a diameter at the posterior end of 1.5^{mm}. While feeding, if the food supply is sufficient, it does not move about much, entire clusters of larvæ often completing their growth in the same bony crevice in which the mother fly had deposited the eggs. When mature, however, it crawls, pulling itself along, apparently by the mouth hooks, into some fold of the wrapper that is comparatively dry and from which the fly will easily be able to escape. Here it begins to contract in length and assume a yellowish hue, and the separation of the outer skin from the body can be clearly seen. The former gradually hardens and darkens into a golden brown, oblong segmented shell, 4 to 5^{mm} in length, and which still retains the larval projections on the posterior end. Within this puparium the larva rests for a time, I have reasons for believing, for thirty-six or forty-eight hours, perhaps longer, unchanged, except for a slight reduction in size. (I had occasion to observe the actions of one of these larvæ whose case was accidentally broken. It wriggled and twisted about in the most unsatisfied manner, but seemed to have lost its skipping power, and was constantly thrusting its head or its posterior extremity into the deserted puparia that were scattered in the bottom of the jar. Whether it was able to complete its transformations I can not now say.)

Both transformations, although involving such radical, formal and functional changes, take place within a period of ten days, as nearly as I have been able to ascertain.

The perfect insect is a shining black fly with bronzy tints on the thorax and slight iridescence of the wings. The latter overlap nearly to the tips when the insect is at rest. The legs are dull black, shaded at the joints to dull yellow or fuscous. In size it is about one-half that of the common house fly. There is no good figure of this insect in any American publication, that in Packard's Guide being in outline merely and not available for recognition except by the skilled entomologist. The fly is not active at night, but is able to perform its life work in the obscurity of partially darkened closets and storerooms. To make these absolutely dark would, in my judgment, effectually exclude it.

I have not been able to make it oviposit on fresh meat of any kind, nor does it seem able to breed upon that which is simply salted, but not smoked, not even when such meat is folded in wrapping papers. It will sip a little at sweets, but is not greatly attracted to them, while the odor of smoked meat speedily summons it. The average duration of life, in the perfect state, in summer, does not exceed a week, according to observations made upon it in the rearing jar, which may not, however, exactly indicate it. The entire life cycle would seem to be included within three weeks, but there is no definite succession of broods, and the insect may be found in all stages from May until October or November. When exposed to severe and protracted cold, larvæ, pupæ, and flies are killed. The flies speedily succumb to

the fumes of burning sulphur or Pyrethrum powder, and the latter, if dusted upon them, produces the same stupefying effect that it does upon other Diptera. The firm in whose behalf these investigations were undertaken informs me that in order to exclude the fly they screened all windows and doors with a 24 to the inch wire mesh. They also, early in the spring, thoroughly whitewashed and fumigated smoke-houses and storerooms, using an admixture of carbolic acid in the whitewash, thus effectually sealing up or killing all hibernating individuals that might be lurking in these places. I have not been able to recommend any repellant chemical that could be safely incorporated with the wash used on the outside of the wrappers. Mr. D——— also informs me that sulphur fumes in the storerooms give a streaked and unattractive look to the wash, and the use of this repellant is therefore impracticable.

Smoked beef also suffers to some extent from the attacks of this insect, but, as Mr. D—— says, "not nearly so badly as pork. If a beef ham were hanging beside that of a hog, the former would most likely be O. K. while the latter would be stung."

In my correspondence with cheese manufacturers I learn that the loss of their products is now far less than it formerly was.

One of our leading cream-cheese makers writes:

We are always somewhat troubled with the cheese flies in summer. To keep them out of our storerooms we cover the windows with light domestic, as they will go through the ordinary wire screen, but as there will always be more or less of them in the rooms, we have the brown fly paper in water always on hand, which keeps them pretty well in check. They are worst during the hot season. We do not use any chemicals as they would be likely to injure the quality of the cheese. The flies deposit their eggs on the outside of the cheese, and in thirty to thirty-six hours they begin to squirm and work their way inside, so we usually go through the rooms twice a day and look for eggs. They are easily found on the smooth surface, but if the bandage is wrinkled or cracked we sometimes miss them. We have not had over $5 worth destroyed in two years, and are turning out 800 cheeses per day.

Another large manufacturer informs me that he

depends mainly upon fine screens to keep out the fly, and also darkens his storerooms; has each cheese rubbed hard each morning; uses no chemicals, but a cheese grease that contains some rosin, which gives a hard coating. Loss not more than 1 per cent., some seasons not over one-fourth of 1 per cent.

These reports are encouraging as showing with what comparative ease the insect may be kept in check when once its habits are thoroughly understood. It is hoped that these few, and not in all particulars conclusive, notes may prove of some assistance in popularizing that knowledge.

Mr. Aldrich spoke of an English custom of placing cheese under the tap of a beer keg so that the drip would encourage the development of the insect. He had been informed that the maggots improved the quality of the cheese.

Mr. Riley said it was true, that this was not only an English but a European practice.

Mr. Coquillett's paper on the use of hydrocyanic acid gas was read by Mr. Garman.

HYDROCYANIC ACID GAS AS AN INSECTICIDE.

By D. W. Coquillett, *Los Angeles, Cal.*

[Read by the secretary in the author's absence.]

One of the most important properties to be desired in any given insecticide is that it possess the ability to completely exterminate the insects against which it is directed. As a rule which has but few exceptions, the more prominently injurious insects are very prolific, and even if only a few individuals remain upon the plant, these in a comparatively short time will multiply to such an extent as to render it necessary to again employ artificial means for their destruction. For this and other reasons that might be mentioned, it is of the utmost importance that the insecticide employed will result in the almost or complete eradication of the insects against which it is directed.

Those who have had any experience with the destruction of scale insects on citrus trees by the use of liquid sprays of various kinds, soon become aware of the fact that even by the use of the best mechanical devices and the exercise of the greatest care in applying the spray, quite a large percentage of the insects will escape destruction. This fact was abundantly demonstrated a few years ago, during the prevalence of the Fluted Scale (*Icerya purchasi*) in some of the orange groves of Southern California prior to the advent of the *Vedalia cardinalis.* At that time the Supervisors of Los Angeles County offered a reward of $1,000 for an effectual remedy for destroying this pest, and appointed a committee of three, of which the writer was a member, before whom the various remedies were to be tested. One of the rules formulated by this committee was that the successful remedy must be able to entirely eradicate the Fluted Scales upon any given tree. Upwards of three dozen different tests were made, many of them by men who from long experience had become very expert in the matter of applying sprays to the trees, and yet in not a single instance were all of the scales exterminated upon one of the trees. In some instances, a curled leaf or a piece of loose bark would be the means of protecting the insects from the spray; and no matter how thoroughly the spraying was done, or how long-continued was the operation, a few of the insects were certain to escape the effects of the spray.

It was with a view to remedy this important defect that in the autumn of 1886 the writer began a series of experiments with various kinds of gases by inclosing the infested tree in a gas-tight envelope or

tent, and then filling the latter with the gas. It must be apparent to all that an insecticide in the form of a gas would reach not only those insects on the inclosed tree that would naturally have been reached by a spray, but also those that might be protected from the spray, since the gas would penetrate every nook and crevice on the tree; in short, would go wherever the air could go. But the gas also posseses another decided advantage over the spray. The application of the latter even when the most approved methods are employed is a laborious task, and the operators, becoming wearied with their work, are almost certain to slight it. To remedy this, a method is desired that operates on the principle of "You press the button—we do the rest." And this we have in the gas treatment. After the tent is on the tree to be treated, the button act consists of simply turning the chemicals into the generator—the chemicals do the rest.

Hydrocyanic acid gas was the first one that I experimented with, and although I have since tested a large number of other gases, including arseniuretted hydrogen, sulphuretted hydrogen, sulphurous gas, carbon bisulphide, nitric and nitrous oxide, ammonia, chloroform, carbonic acid gas, and carbon monoxide, yet none of them gave as good results as the one first mentioned. Some of the gases were much slower in becoming diffused throughout the space inclosed by the tent, others were more severe in their effects upon the tree, while several, which were commonly supposed to be very deadly to animal life of every description, produced very little impression upon the insects against which they were employed.

A long line of experiments which the writer carried, out under the auspices of our national Division of Entomology at Washington, establishes the fact that the best results will be obtained by generating the gas from undiluted commercial sulphuric acid and undissolved fused potassium cyanide of about fifty-eight per cent purity, the proportions being: one fluid ounce of the acid, one ounce by weight of the cyanide, and three fluid ounces of cold water. For a generator, almost any open earthen vessel will answer, its size depending upon the size of the tree or plant to be treated. The necessary quantity of water is first poured into the generator, followed by the acid, after which the generator is placed on the ground under the tent and the cyanide added. Experience has shown that the best time for treating the trees is at night, or during cool, cloudy days; at such times the trees are more or less in a state of rest, and therefore less liable to be injured by the gas than if subjected to it during bright, sunny days. Moreover, as is well known, this gas is not very stable even under the most favorable conditions, but it is less liable to decompose when kept at a low temperature than if subjected to any considerable degree of heat. For these reasons the best results will be obtained by using it only during cool weather, and experience has shown that the various

kinds of scale insects are quite as susceptible to its influence during cool weather, or at night, as they are at any other time.

It will, of course, be quite impossible to lay down any fixed rule in relation to the proper quantity of the chemicals to be used on any given tree. Experience has shown that a tree possessing a dense foliage will withstand unharmed a much stronger dose of the gas than will a thinly-foliaged one, the supposition being that in the former case the gas is distributed to such a great number of leaves that its effect upon each leaf is not so severe as would be the case if there were fewer leaves to receive it. In a general way, we may say that each 180 cubic feet of space inclosed by the tent will require one ounce of cyanide and the other materials in the proportions given above.

The material commonly used in the construction of the tents for inclosing the trees is what is known as "eight-ounce duck." At first it was the custom to manufacture this into bell-shaped tents, but experience has shown that simple sheets will answer the purpose quite as well as tents, besides being less expensive and much easier to remove from the trees. These sheets are made in the form of an octogon, since it requires less labor and there is less waste of material in constructing them of this form than would be the case if they were made circular.

In the case of very large sheets, it is customary to use a heavier material for the two middle breadths, since it is on this part of the sheet that the principal strain falls in placing the sheet upon the trees and in removing it again; for these two breadths the "ten-ounce duck" is used.

Several tests made with unpainted tents prove that it is not desirable to use them in this condition, since they permit of the escape of a large quantity of the gas, and in order to render them gas-tight they are painted over with linseed oil, with or without the addition of other substances. Among such substances may be mentioned yellow ocher, lampblack, sizing, whiting, beeswax, and soapsuds. Perhaps the substance most commonly used is a thin paint made from yellow ocher, this being lighter in weight and less expensive than most other paints. It would, of course, be very desirable to employ some kind of ready-prepared cloth in the construction of the tents, but thus far my efforts at obtaining such material have not been successful. The nearest approach to it is a rubber cloth, but even the cheapest grade of this is almost three times as expensive as the painted cloth described above.

In regions where cactus abounds, the mucilaginous juice of this plant may be used in place of linseed oil; the cactus is simply cut into small pieces, thrown into a barrel, and covered with cold water; after standing for a day or two it is ready for use.

Where the trees are less than twelve feet in height, the sheets can be placed over them and removed again by the use of poles, but on

trees taller than this an apparatus of some kind, furnished with ropes and tackle, will be required. The simplest apparatus of this kind consists of two upright posts, one on either side of the tree, with a pulley at the top of each and a rope passing through it and attached to the sheet. This simple device, which can be constructed in a short time by almost any person, can easily be moved by hand from tree to tree as occasion requires. In throwing the sheet over the tree the uprights are allowed to fall to the ground; being very light affairs, they are easily raised again when it is desired to remove the sheet from the tree.

After the sheet is on the tree the slack at the bottom is gathered in and pressed firmly against the ground by stepping upon it, this being sufficient to prevent the escape of the gas between the lower edge of the sheet and the surface of the ground. The gas, being lighter than the air, rises and diffuses itself throughout the inclosed space without the aid of any kind of artificial means, and this is true even in the case of trees thirty feet in height.

The length of time that the gas should be confined on each tree will depend on the size of the tree, varying from fifteen to thirty or even to forty minutes. By employing a sufficient number of sheets or tents, no time need be wasted by those operating them, since, by a proper adjustment, the tent first placed on the tree can be removed as soon as the last one has been adjusted and charged with the gas, and the removal of the other tents will follow in their natural order.

The use of this gas is fast superseding all other methods for destroying scale insects on citrus trees in southern California, and it could also be employed for the destruction of several other classes of injurious insects. The complete eradication of insects on imported nursery stock is of the utmost importance, and for this purpose the gas treatment is especially adapted. It must be borne in mind, however, that the effects of this gas are not the same upon the various different kinds of insects, and even among the scale insects themselves this fact is very noticeable. As a rule, the Diaspinæ are more easily affected than any other kinds; and, as might be expected, the insects themselves are more susceptible to the effects of the gas than are their eggs. Mites are but little affected by the gas beyond a temporary insensibility, or, at least, what appears as such, since in most cases they recover from the effects of their forced sleep, and appear to suffer no inconvenience therefrom. On the other hand, the gas is very fatal to spiders. Among the higher insects, the Diptera and Hymenoptera are very susceptible to its influence; Hemiptera and Coleoptera less so.

When I first began to use this gas as an insecticide, a great cry was raised against it on account of its very poisonous nature, as well as that of the chemicals used in its production. So very pronounced was this feeling that even the analytical chemists of this city refused to make an analysis of the potassium cyanide on account of its highly poisonous nature. And yet, in the past seven years, during which

time this gas has been largely used by myself and others, I have yet to hear of the first instance wherein a single human being has received any serious injury either from the gas itself or from the chemicals employed to produce it. Occasionally a barnyard fowl that may chance to be in the tree at the time it is treated will be sent into the next world by the shortest practical route; and small birds, as well as lizards, sometimes share a similar fate, but cases of this kind are rare, and could in most instances be prevented by exercising due precaution.

At the present price of the chemicals used, the cost of treating citrus trees with this gas will vary all the way from 5 cents to $1 per tree. This latter sum may seem to be an exorbitant one to pay for ridding an orange tree of the scale insects that infest it, and yet our fruit-growers find themselves well repaid for expending so large a sum of money for this purpose. One of the greatest pests at present infesting the orange groves of southern California is what is commonly known as the Black Scale (*Lecanium oleæ* Bernard); while this pest does not devitalize the tree it infests to the same extent that some other kinds do, still the black fungus, which always accompanies its attacks, renders the fruit so unsightly that it is necessary to wash the latter before placing it upon the market. The cost of thus washing a box of oranges amounts to about 20 cents per box. An orange tree large enough to require the expenditure of $1 to treat it with the gas will yield on an average fifteen boxes of oranges, and to wash these would require the expenditure of about $3, as compared to $1 to fumigate them. This fact is not merely a theoretical one, but has been demonstrated again and again by different orange-growers in this district. Not only is it cheaper thus to fumigate the fruit on the tree, but it also leaves the fruit in better condition, since, as is well known, washing oranges impairs their keeping qualities. In addition to this, the fumigated tree, being rid of the pests whose attacks continually weaken its vitality, will be in much better condition to produce a superior grade of fruit.

At a recent meeting of the county horticultural commissioners of southern California, one of the commissioners, Mr. B. J. Perry, reported having treated 47,000 citrus trees, at an average expense of less than 25 cents per tree. This is but slightly in excess of what it would cost to spray them, and this slight difference in the cost is more than counterbalanced by the better results obtained, the less labor involved, and the better condition the trees are left in after the operation is completed.

The following paper was then read:

ON ARSENICAL SPRAYING OF FRUIT TREES WHILE IN BLOSSOM.

By J. A. LINTNER, *Albany, N. Y.*

[Read, in the absence of the author, by J. B. Smith.]

The long-mooted question, Are honey bees poisoned by arsenical spraying? is still an unsettled one. There are those who claim that a great mortality among bees is the result of their visiting blossoms that have been sprayed with Paris green, while others hold that the mortality so frequently observed at this time is ascribable to other causes, and that the arsenic would not reach the nectar of blossoms, and, being an insoluble substance, could not affect the bees or be communicated to the honey. This latter view has been entertained by some of our best botanists. The pollen, however, might contain arsenic and thus become poisonous, not only to the bees visiting the blossoms, but also to the nearly-matured, chyme-fed larvae to whom it might be conveyed.

In behalf of a committee appointed by the Association of Economic Entomologists to investigate the matter, Prof. F. M. Webster, of the Agricultural Experiment Station of Ohio, chairman of the committee, has recently reported progress in the investigations undertaken, to the following effect: He had experimented with a hive of bees placed underneath a sprayed plum tree wholly inclosed with a fine netting. Within two days thereafter a large number of dead bees were taken up from the cloth with which the ground had been covered. Without much doubt, most of these had been killed in their efforts to escape from their confinement. Examination of the bodies of the dead insects before washing and after they had been washed to remove any arsenic that had been attached to their surface from contact with the sprayed blossoms, gave to the examining chemist the presence of arsenic. In another experiment made, hives of bees were placed under sprayed trees, but without any inclosing net. These also gave dead bees with arsenic upon them, but in much smaller number.* The experiments were not deemed conclusive by Prof. Webster, and it is intended to continue them another year.

That the bodies of crushed bees that had visited blossoms sprayed with arsenic should disclose to chemical tests the presence of arsenic is not at all strange. Even an ammoniacal bath could not have removed every trace of arsenic from the surface of their bodies.

* It is possible that these bees may have been caught and killed by some of the predaceous insects which are known to lie in wait among or near blossoms, whence they suddenly seize the bees and suck out their *juices*, such as the bee-slayer, *Phymata erosa*, and several of the "robber flies" or Asilidae, of which Prof. A. J. Cook records six species having this habit.

Prof. A. J. Cook, the distinguished apiarist of the Michigan State Agricultural College, makes the positive assertion that honey bees are killed in large numbers through the arsenical spraying of fruit trees in blossom, but he has not proven the assertion. Experiments instituted by him in which bees fed on sweetened water poisoned by arsenic—1 pound to 200 gallons—were killed, are claimed by him as decisive upon the question under consideration. How entirely unwarranted the conclusion! The experiment had no bearing upon the question at issue. No one could have doubted that imbibing strongly poisoned sirup would be fatal to honey bees. Furthermore, in his experiment (see Report of the Michigan Board of Agriculture for 1891) the bees were fed in his laboratory, within a small cage. Bees are known to die very soon in confinement, even without an arsenical diet. (Howard, in INSECT LIFE, Vol. V, 1892, p. 123.)

A simple method can be resorted to by which the question could be definitely and effectually settled. It is this: Confine a hive of healthy bees to blossoms sprayed with Paris green, and when death speedily follows, have examination of their stomachs made by experts testing for arsenic. If it is found therein, then it may be accepted as the cause of their death. Examination of stomachs of bees collected promiscuously would not be satisfactory, for the statement was made at a recent bee-keepers' convention in Albany that honey bees had been seen eagerly feeding on the liquid resting on the leaves of a potato patch soon after it had been arsenically sprayed, and it was thought to have caused the death of many of the bees.

Up to the present, so far as I know, no examination such as above suggested has been made. I hope that Prof. Webster will undertake it, in the progress of his experiments the coming season.

Prof. Cook desires that "everyone of the United States should pass a law making it a misdemeanor to spray fruit trees while in blossom." I do not know that this, although urged in some of the States, has been done in any. Such a law was passed by the Ontario legislature, in April, 1890. It provides:

SEC. 1. No person in spraying or sprinkling fruit trees during the period within which such trees are in full bloom shall use or cause to be used any mixture containing Paris green or any other poisonous substance injurious to bees.

SEC. 2. Imposes a penalty, on conviction, of not less than $1 or more than $5, with or without costs of prosecution.

That the above law is calculated to protect the interests of both the fruit-grower and honey-producer, is the opinion of Prof. J. H. Panton, of the Ontario Agricultural College, as given in Bulletin LXXXI, of the college, issued in November, 1892. He remarks:

Although there has been no analysis of the bodies of the dead bees for the purpose of ascertaining the presence of arsenic, still the death of the bees is so intimately associated with spraying that there seems but little reason to believe otherwise than that the bees have been poisoned by Paris green used in spraying. However, this will likely soon be settled by analysis of the bodies of bees suspected to have been poisoned, and I have no doubt arsenic will be detected.

There is another important question connected with the arsenical spraying of blossoms, viz, this: May not the arsenic blight the blossom and prevent fruit development? "The portion of the pistil," says Prof. Panton, "upon which the pollen falls is exceedingly tender and sensitive, so much so that the application of such substances as Paris green injures it to so great an extent that the process of fertilization is affected and the development of fruit checked." No experiments known to me have been made upon the effect of arsenical spraying on fruit blossoms. That its effect would be to destroy the blossoms is quite probable. Thus, Mr. James Fletcher has suggested the spraying of the blossoms of pear trees infested with the Pear Midge (*Diplosis pyrivora* Riley) as a remedy for annual attacks of the insect by depriving it of the food (within the young fruit) needed for its development.

There are, then, before the economic entomologist and the fruit-grower at the present time these two questions relating to spraying with the arsenites during the blossoming of fruit trees: First, will the poison kill the bees, destroy the young brood, and affect the honey? Second, will it blight the blossoms? It would not be a difficult task for an experimental station, and it is specially within the province of the stations, to set these questions at rest and no longer leave them subject to crude observations or individual opinions. Until this shall be done, there should be an entire cessation from arsenical spraying of fruit trees while in blossom, without the enactment of laws which now seem premature and may prove to be not needed; and even if seeming to be needed, are still fraught with evil, from the general disregard with which such laws are treated.

It is unnecessary to say that there should be no restriction of the kind, either optional or compulsory, unless it is shown to be absolutely required. The arsenical spraying of fruit trees has already come to be regarded as almost indispensable to the successful fruit-grower, and day by day its importance is being more fully and widely realized. No longer limited to the control of Codling Moth injury, it is being rapidly extended to other insect attacks. For each week of early spring, I have no doubt but that a calendar could be made wherein each day would stand for the incipiency of attack by some insect pest or fungous disease, to be combatted in no better way than by arsenical or copper solutions sprayings. What opportunities may therefore be lost for arresting and defeating attack at the most favorable time, and possibly at its only vulnerable stage, if two or three weeks' armistice is accorded to your enemies, during which time the army is recruited a hundredfold, the infant becomes a veteran, mines are run, pits are dug, tents are built, covered ways are constructed, insidious mycelium threads are permeating leaf and twig, and in many other of the arts of warfare your wily foes, with their rich inheritance of surprising means for self-protection, have planted themselves in strongholds where an entire park of spraying pumps with their baneful poisons will utterly

fail of reaching and destroying them. Far better a cessation of hos. tilities for any six weeks later in the season than for three in early spring. It has been stated and reiterated many times that the Codling Moth is the only insect against which we need to employ the arsenites in early spring, but this is far from the truth. It is conceded that we can not destroy the Apple Worm until after the fruit is set and the egg deposited thereon, but of the two hundred and eighty known species of insect depredators on the Apple (not referring to those infesting other fruits) it would be strange indeed if there were no others which are specially vulnerable before the setting of the fruit. Let me name a few of those that could be reached at this time:

The well-known Apple-tree Tent-caterpillar of *Clisiocampa americana* Harris, attacks the bursting buds and the young leaves.

The caterpillars of the White-marked Tussock-moth (*Orgyia leucostigma* Sm.-Abb.) hatch from the eggs about the middle of May and commence their destructive work.

Among the cut-worms there are a number of climbing species, four of which have been identified, viz, *Agrotis clandestina* Harris, *A. scandens* Riley, *A. messoria* Harris, and *A. saucia* Hübn., which are known to ascend apple and other fruit trees to feed upon the blossom and leaf-buds and the tender leaves. The odd-looking caterpillar of *Catocala grynea* Cramer, feeds on the foliage of the apple in May, and those of *Catocala ultronia* Hübner are often shaken from plum trees when jarring them for the curculio.

The Canker Worm (*Anisopteryx vernata* Peck) usually appears as the young leaves are pushing from the bud.

The White Eugonia (*Eugonia subsignaria* Hübn.), one of the family of measuring worms, occasionally appears in injurious numbers about the 1st of May.

The Oblique-banded Leaf-roller of *Cacœcia rosaceana* Harris, spins together the young leaves for its shelter.

The Lesser Apple-leaf Folder (*Teras minuta* Rob.) attacks the opening foliage and folds the leaves for its retreat.

The Leaf-crumpler (*Phycis indiginella* Zeller), awakening from its winter's sleep and drawing some of the unfolding leaves together, resumes its feeding.

The destructive Eye-spotted Bud-moth (*Tmetocera ocellana* Schiff.), so injurious in western New York, after its larval hibernation in its half-grown state, makes its formidable attack, first on the buds and afterward on the leaves.

The Apple Bud-worm (*Eccopsis malana* Fernald) creeps at night from its retreat and, after having consumed the terminal buds, feeds upon the leaves.

The Apple-tree Case-bearer (*Coleophora malivorella* Riley) emerges from its peculiar pistol-shaped case in which it has passed the winter, to eat the buds as soon as they begin to swell, and afterwards to skeletonize the leaves.

The Plum Curculio (*Conotrachelus nenuphar* Herbst) enters upon the scene at least two weeks before its first crescent cuts are made in the fruit, ready and free to devote all its energies to obtaining the supply of food needed for the development of its eggs and for the labors attending its complicated and painstaking method of oviposition.

Seventeen species of insects are named above, each one of which is feeding voraciously during the blossoming of our fruit trees. Possibly as many more could be added to the list, all of which could best be destroyed by arsenical spraying.

It is therefore respectfully submitted whether there should be the intermission of spraying as proposed, urged, and sought to be made compulsory through legislation, until it shall appear beyond all controversy that the interests of the agriculturist and the fruit-grower—each carefully considered and perhaps weighed one against the other—really demand it.

In the discussion following, Mr. Webster stated that he had as yet reached no positive opinion as to the poisoning of bees by spraying.

Mr. Garman had observed in one instance a bee alight on a recently sprayed tree and suck up from a leaf a drop of the liquid containing London purple. He had no doubt that thirsty bees did sometimes get in this way some of the poison, but whether it was sufficient to injure them or not was a question requiring investigation.

The Association then adjourned to meet at 2 o'clock p. m.

FIFTH SESSION—AUGUST 16.

The Association was called to order by Vice-President Smith at 2 p. m.

The committee on nominations reported the following officers as its selection for the next meeting:

For President, L. O. Howard, Washington, D. C.
For Vice-President, J. B. Smith, New Brunswick, N. J.
For Second Vice-President, F. L. Harvey, Orono, Me.
For Secretary, C. P. Gillette, Fort Collins, Colo.

On motion the by-laws were suspended and the secretary was instructed to cast the ballot of the Association in favor of these nominations. They were declared elected.

The following paper was then read:

SOME INSECTS OF THE YEAR.

By F. M. Webster, *Wooster, Ohio.*

Epicauta cinerea Forst., *E. vitatta* Fab., *E. pennsylvanica* De G., are all exceedingly abundant in Ohio this year and very destructive.

Crioceris asparagi Linn.—This pest of the garden in its westward march has reach Cleveland and Akron, Ohio, having probably crossed the Alleghanies via the Ohio River and its tributaries.

Systena blanda Mels.—This beetle has proven very destructive to beans in Ohio the present summer. Large fields were seriously damaged.

Euschistus variolarius P. Beauv.—Observed puncturing the skin of ripening tomatoes, numbers being clustered on a single tomato and the juice oozing from the punctures. They also attacked peaches in a similar manner.

Phytonomus punctatus Fab.—This species reached Wooster, Wayne County, Ohio, this year for the first time, adults having been observed on several occasions during June and July. The larvæ fed on white clover, leaving the red clover untouched.

Otiorrhynchus ovatus Linn.—Reared adults from pupæ found in blue-grass sod in June, both being present. Larvæ observed in May.

Macrodactylus subspinosus Fab.—This species was found in the larval stage in great abundance in a field of wheat early in May, distributed among the roots upon which they had clearly been feeding. The same field had produced wheat the preceding year. At the time of examination the roots had many of them been eaten, and the plants above ground were not in thrifty condition.

Epitrix parvula Fab.—The adults worked considerable injury to tobacco in southwestern Ohio by eating numerous holes in the leaves.

Thyridopteryx ephemeræformis Haw.—This has been especially injurious this season in southern Ohio—it does not occur elsewhere in the State—and I have nothing new to record except that about North Bend it is parasitized to a limited extent by a Dipteron, probably a Tachinid, as I have found the pupa protruding from the lower or posterior end of the sack and somewhat resembling the anterior end of the pupa of the male Thyridopteryx, as the latter is first pushed forth, preparatory to the emerging of the imago.

The following paper was then read:

INSECTS OF THE YEAR IN NEW JERSEY.

By JOHN. B. SMITH, *New Brunswick, N. J.*

It was with a considerable amount of curiosity that I looked forward to the opening of the season of 1893. The unusual character of the winter, the bitter and prolonged cold, without any real open spell, led me to expect surprises. There seemed to be among farmers a very general opinion that the cold winter had killed off a very great proportion of species, and that probably there would be little or no trouble. My own experience had led me to believe the contrary, and I was curious to see which would prove most nearly correct. As a matter of fact both parties were right; that is to say, some insects were undoubtedly very greatly cut by the severe winter, while others on the contrary hibernated unusually well. Most of the common pests made their appearance in their normal abundance, and some indeed were considerably in excess; as, for instance, the Elm Leaf Beetle, which I do not remember ever to have seen in anything like the numbers in which it made its appearance this spring. A number of others of the common species did equally well, while on the contrary others seem to have been very greatly reduced in numbers. In the melon fields, in which I made observations as soon as there were melons to be observed, the striped beetles *Diabrotica vittata* were in most localities very much fewer than I have ever known them. Only in sheltered places, near the edges of woods or shrubbery, or near barns or other buildings, wasthere much injury. The Boreal Lady Bird (*Epilachna borealis*), which for several years past has increased steadily in numbers, was this season to be counted among the rarities; only here and there was a specimen to be found where in the two previous years hundreds could have been taken. The common Squash Bug (*Anasa tristis*), was also notable by its diminished numbers. Only here and there could a specimen be found, and egg clusters, usually so prominent everywhere through the fields, were this time few and far between. Of the melon lice, which two years ago were in such an enormous abundance, I have not yet found trace in any part of the State. I made diligent and faithful search, not only in the melon fields, but on all kinds and descriptions of plants in their vicinity, and studied closely every specimen of louse that at all resembled those that I was seeking. To the courtesy of Mr. Walker, of Jamaica, Long Island, I owed a considerable number of cocoons of the Squash Borer. Those I kept in a breeding cage in my laboratory, looking after them from time to time to note the date of pupation. Not until spring was well advanced did any of the larvæ pupate; that is to say, they remained in their cocoons in the larva state throughout the winter, and did not pupate until a short time before they were ready to transform

into moths. The first specimen made its appearance in my breeding cage May 15; others, one at a time, appeared until June 1, on which day I had 7 imagos. At that time I cut open a considerable number of the cocoons and carefully emptied out the box of moss in which they had been kept. I found several pupæ making their way up to the surface, and found in the cocoons a number that had just transformed. Found also, in others, a very fair proportion of larvæ that as yet showed no signs of changing. Specimens continued to issue throughout June, the last specimens which I recorded making their appearance early in July. It is very likely that in nature the time of the appearance of the insects is equally spread out, making it a yet more difficult one to deal with. It is not likely, however, that in the open, many specimens will issue quite as early as they began to issue in my laboratory. From what I have observed, the insects wintered in the field just about as well as they did with me, and I have already heard from several localities that the borers were out in force.

Cutworms also wintered remarkably well, except on those farms in which the commercial fertilizers were used. There was a very great difficulty in getting a stand of a considerable number of crops. Melons, sweet potatoes, and corn were cut with great severity, and replanting of all of these crops had to be done; in some cases as many as three or even four times. Corn, in fact, was an unusual sufferer in New Jersey this year. The "Bill Bug" did not make its appearance at all, so far as I have heard, even in those localities in which it was very much the worst last year; but on the other hand there was an enormous increase of injury done by the "Corn-root Web-worm," the larva of a species of Crambus which I have not attempted to bring to maturity. This insect has in some cases made replanting necessary over large areas, and even now, at the present time, there are fields in which these insects can be found in considerable numbers, and in which the corn is a very irregular and unsatisfactory stand. These web worms are very much the worst on old sod land, where they probably infested the grasses in previous years, and this insect too is almost entirely absent on these farms on which the commercial fertilizers are used to the practical exclusion to barn yard manure. In fact this more than any previous year has emphasized the exemption enjoyed by those farmers who habitually used the mineral fertilizers. Besides this web-worm, seed corn, or the young corn plants were also attacked by a Span Worm, the larva of a Geometrid. This was sent me by Mr. Crane, of Caldwell, who is trying to bring it to maturity. The larva is a very strongly marked one, and he says that he feels certain that he has seen it in previous years in the stalks of Dahlia and in Pigweed. An Anthomyiid larva was also injurious locally. The Anthomyiid was bred; but has not been specifically determined. A feature in some parts of southern New Jersey was an invasion by a Flea Beetle, *Systena blanda*. This insect I had never previously found in anything

like troublesome numbers; but this time for some reason they were present in countless numbers. In Monmouth and Cumberland counties carrots were almost entirely destroyed by them. The fields were attacked when the young plants had just made their appearance above ground, and were eaten off so completely that in the course of two or three days nothing was left on the ground. Young beets were then attacked, but not so generally as were the carrots. The insects manifested a very catholic disposition so far as their food was concerned, and ate almost everything that came to hand. Melons of all kinds, grown in some places, had the leaves riddled by them, while every plant of Pigweed bore a dozen or more specimens; in fact Pigweed seemed to have been a very great favorite, and in some cases even these plants were killed by the attacks of the insects. The attack was over, however, in two or three weeks, and since that time few of the insects have been seen. I have made no attempt to work out the life history of the insects, as I have been under the impression that it has been already worked out, or was being studied by Mr. Bruner.

Another insect that stood the winter remarkably well was the Sweet-potato Flea-beetle, *Chœtocnema confinis.* This made its appearance in perfectly enormous numbers in Gloucester and part of Salem counties, fairly riddling the leaves with its peculiar channels. The insect does not seem to spread very much; but I have found specimens of its work on the Bind-weed in Cumberland County. It is more than probable that this Bind-weed is really the ordinary food plant of the insect, and that from this it has come to sweet potato. I have been again unsuccessful in getting at the early stages of this species with any degree of certainty, though I am now convinced that the larva of the insect lives in the small rootlets which are so abundant on the sweet potato plant. I have noticed in a number of cases of plants that have been badly infested by the beetles early in the spring, that about three weeks later a great many of these small rootlets had been apparently eaten out. I did not find any larvæ, but hardly know to what else this injury could be attributed: there is certainly no other part of the plant that nourishes the larvæ. I kept a large number of specimens of the beetle in confinement for about two weeks in a jar containing growing plants; but failed to obtain upon them either eggs or larvæ, although the beetles copulated freely in confinement. One fact I have learned through the Philadelphia collectors, and that is, that the beetles again make their appearance in July and August, and that they hibernate as adults. Specimens have been sifted out by Mr. Wenzel from material collected in January. This explains also why insects are always first seen at the edges of fields adjoining roads, fences, and especially woodlands.

One of the unexpected occurrences of the season was the abnormal increase of the "Wheat-head Army-worm," the larva of *Leucania albilinea.* In two or three counties of the State north of Trenton and

along Delaware it did a very considerable amount of injury, making its appearance just as the grain was ripening. This is one of those creatures against which we are more or less helpless, and the only advice that I was able to give to the farmers was to harvest the wheat just as soon as they possibly could. The advice was followed very generally, and a conservative estimate placed the damage done at about 10 per cent of the amount of the crop. A very large proportion of these larvæ were parasitized, principally by a Tachinid; but the fact that so large a proportion was parasitized did not, so far as I have been able to ascertain, lessen the injuries sustained by the farmers in the least. I have been puzzled to know what peculiar local condition caused the sudden increase of this species. It is something which the farmers themselves say they had never seen before; but this of course means nothing, for I know that the moth is one of those that is moderately common every year. In other parts of the State where the moth is equally common there was no unusual increase.

Raising onions for seed, for sets, and for market, is quite an industry in Cumberland County, and heretofore nothing in the way of insects has troubled the crop. One of the largest growers in that county, and at the same time one of the best farmers in the State, had familiarized himself with the insects that were elsewhere most troublesome, and had been keeping a very close lookout for the onion maggot, which was known to be injurious in other portions of the State. In May he wrote me that he had found a very considerable percentage of the sets planted for bulbs to be infested by the maggots, and that not he alone, but his neighbors as well, suffered equally. He asked an explanation of how this insect could have appeared in such numbers, and over such an extent of country, when it had not been previously known anywhere in the vicinity. Of course I failed to answer the question, since I could only suggest that probably the insect had been present in the vicinity in small numbers, and had not been noticed; but had found unusually favorable conditions for its increase during the present year. Heroic remedies were at once adopted; plants were taken out where they showed signs of attack and were destroyed; in addition to that the soil was turned away from the tubers, kainit, at the rate of 500 pounds to an acre, was applied, and the soil turned back again to the rows. Two weeks later when I visited at the field, no trace of the onion maggots could be found; nor did they again make their appearance at any time later, or up to the present time.

It is rather a remarkable fact that not only the insects should have made their appearance in such numbers where they had not been known previously, but also that they should have been so completely destroyed by the measures adopted. There was one fortunate circumstance connected with the outbreak, and that is that all the onion-growers in the vicinity were intelligent men, who fully appreciated the danger, and who did not hesitate a moment in adopting the remedies

suggested. Another insect which I had not previously noticed was also unusally abundant in the onion patches. I refer to a small yellow Thrips, which was present in countless numbers on the leaves of the plants, sucking the juices; or more correctly, perhaps, scraping small portions of the outer skin, which became yellow-spotted. In a great many fields the insects were so abundant, and these yellow spots so close together, that practically the leaves were killed. This was aided by the fact that in this region there was an excessively severe drought, which checked the growth of the onions and prevented their recovering from the effects of the injury. Before the middle of July these insects had practically disappeared. It is probable that this insect has been present previously, but that the onions, in ordinary seasons, are able to withstand the drain without trouble. About the time that the bulbs were matured, a bacterial disease made its appearance here and there in the field, and these bulbs, even when only slightly affected, were covered with innumerable quantities of mites. I have, as yet, made no attempt to ascertain the species, and know nothing about the creature, except that it is white, and has chestnut-colored legs. Besides mites, certain fly larvæ also attacked these onions, and these were at first supposed to be onion maggots. As soon as I found egg-masses, however, I realized that there was probably an error, because the eggs were beautifully ribbed, which, I believe, is not a characteristic of Anthomyiid eggs. I succeeded in breeding a considerable number of the flies, and find that it is a species belonging to the *Ortalidæ* or *Trypetidæ*. I have seen the flies only in the breeding jar, and therefore can not give any more definite information concerning them. I bred also, from other onions, two or three species belonging to the Muscids, which are also yet in the breeding jar, and have not been examined with the view of identifying them.

The Strawberry Weevil (*Anthonomus signatus*) was troublesome in a few localities in southern New Jersey; but did not injure any very large proportion of the crop. I did not learn of the appearance of the insect until it was too late to make personal investigations, hence depended upon hearsay for estimates of injury caused.

The Twelve-spotted Asparagus-beetle (*Crioceris 12-punctata*) was again found in considerable numbers in Gloucester County, where I had taken it last year. It was also taken by me much further south in Cumberland County, and was taken by the Philadelphia collectors near Camden. The insect thus has covered a considerable proportion, embracing nearly the whole of the sandy plains, of the State; even where it was most abundant, however, it is in no sense a rival to the older *C. asparagi*. I found this year one of the growers practicing a method of destroying the larvæ in his young plantations which had the merit of extreme simplicity, combined with the utmost effectiveness. He simply went over the entire patch in the middle of the day with a long stick, with which the plants were gently brushed in such

a way as to dislodge the feeding larvæ. They dropped quite readily, and as I followed him along the rows I found that a very small percentage only of the larvæ remained upon the plants. Those that were knocked off on the burning hot sand died in a very few minutes, and none of them ever found their way back upon the plants. This is not surprising, because in the middle of a warm day the sand becomes so hot as to be almost unbearable to the touch, and these soft insects when thrown upon it died within a very short time. This process would have to be repeated only a very few times in the course of the season to keep the plants entirely free. This method is useful, of course, only in young beds; but in the older beds which are cut regularly the insects can be kept down without any trouble, either by close cutting or by means of trap shoots. We are able thus to control this species, which only a few years ago seemed to threaten the asparagus industry in some parts of New Jersey.

The Pear Midge has been spreading in the State; but very slowly. I found it this year in Monmouth County, further south than it had been in previous seasons, and present only in very small numbers, in the Lawrence pears. Near New Brunswick, in the orchard in which I first discovered the insect, the Lawrence had made an excessively heavy set of fruit, and in the entire orchard there was not a single pear of this variety which was not infested by these midges. Some other orchards near by, which last year had not been attacked, were also seriously injured this season. On the other hand, in an orchard in which last year there were a considerable number on this variety there were fewer than there were in 1892. This is to be accounted for by the fact that on my recommendation the owner of the orchard plowed the ground under his trees in fall, and applied kainit at the rate of 1,000 pounds to the acre. The result is that this year he is practically free from the pest, even though his orchard adjoins the one previously mentioned, in which every solitary pear was full of midge larvæ. I succeeded in inducing the owner of this infested orchard to permit the trees to be entirely stripped of fruit, and I hope that in this way some protection against the spread of the insects will be afforded. I am unable to say positively, of course, that it was the kainit which prevented the appearance of the midges where it was applied; but I have now under way a series of experiments which will, I hope, give some definite information on this subject.

Altogether the season has not been an unfavorable one in our State so far as insect injury is concerned. I am extremely pleased to be able to say that in most localities the better class of farmers, those that make money by farming, are ready to adopt any reasonable methods suggested by the station for the control of insects and other pests, and I believe that there are few States where the farmers have learned to trust the station officials as thoroughly as they have in New Jersey. There is perhaps no other State in which the station workers are so generally acquainted with the farmers of all sections.

The following paper was then read:

NOTE ON SOME OF THE MORE IMPORTANT INSECTS OF THE SEASON.

By HERBERT OSBORN, *Ames, Iowa.*

The present season has so far been marked by a rather exceptional abundance of several common pests. During the fore part of the summer the Clover Hay-worm (*Asopia costalis*) attracted considerable attention, many of the larvæ and specimens of their work being sent to me from different parts of the State. It would seem that the species has been increasing rapidly along with the increase of clover hay put up in this region. In some cases the injury has been caused by *Asopia farinalis*, although from many of the specimens *Asopia costalis* has been bred.

The Wheat-head Army-worm (*Leucania albilinea*) has also attracted considerable attention, causing serious losses to timothy seed crop, but its distribution has been different from what it has usually been in the State. This season the injuries reported have been mainly in the northeast quarter, and but few reports and probably less injury has occurred in other sections. Formerly its greatest damage has been known in the southeast quarter.

The Potato-stalk Weevil (*Trichobaris trinotata*) has been, if anything, more common and destructive than before and is probably to be credited with considerable injury to potatoes that has been assigned to other causes or referred to dryness.

Several species of Acriididæ have been very plentiful and their injuries much more noticeable than in ordinary seasons. *Melanoplus femur-rubrum* has been the most abundant species, but *differentialis* and *bivittata* have been unusally common and other species of the family have also been present in abundance. Pastures and meadows have suffered from their great numbers and they are affecting cabbages and other garden plants and have also completely stripped a number of apple and other orchard trees, a phase of injury which I have never before observed at Ames.

The Horn Fly, which has been rapidly spreading over the country, has appeared in large numbers at Ames this season and is proving quite troublesome to cattle.

In discussing these three papers Mr. Riley remarked that the arsenical poisoning for the Blister Beetles was effective so far as killing the beetles was concerned, but that the difficulty in the case was that they continued to come from day to day. In large potato fields the driving and burning methods have proved at times quite effectual, but during years when the insects are very numerous it is almost impossible to protect given plants or smaller areas. He had found this to his

sorrow in trying to protect certain choice clematis plants in his own garden during the past two years. A succession of species would continue their defoliation, notwithstanding all methods of destruction.

The following paper was then read:

ICERYA PURCHASI AND VEDALIA CARDINALIS IN NEW ZEALAND.

By R. ALLAN WIGHT, *Auckland, New Zealand.*

[Read, in the author's absence, by H. Osborn.]

The course which these two insects have run in New Zealand, although remarkable, is perhaps very similar to the experience of other countries, but there are some circumstances which appear to be very extraordinary and not too easy to understand. The Iceryæ were first seen in a small group in Auckland, and looked upon as a harmless curiosity. Dr. Purchase, an Auckland divine and physician, sent specimens to Mr. Maskell, who gave the insect the specific name of *purchasi*, for, although it had long been known to Australian entomologists, it had always been considered as identical with *Icerya sacchari.* It spread with wonderful rapidity, till every green thing seemed covered with it, when suddenly it received a check and as rapidly disappeared, as if by magic, and, strange to say, not one person in Auckland had noticed the Vedalia that destroyed it or had the least idea that such a beetle was in existence, incredible as it may seem. Mr. Koebele was the first man to discover the beetle and its action in Australia, and another person was the first to do the same in Wairoa South in New Zealand, but it was a close run, for Mr. Koebele was then at Napier, where he procured the bulk of his Vedalia. Perhaps the most singular circumstance connected with the arrival of Icerya in New Zealand is the fact that, although both insects were undoubtedly imported from Australia, those which were introduced upon imported plants were the exceptions to the rule. In several districts, where the matter was properly observed, it was found that the nurseries with imported acacias and citrus plants were not the places first infected, but the acacia hedges, which had been grown years ago from seed, and the patches of gorse, self-sown, and far away from cultivation and imported plants. This occurred not in one district only, but in several.

An interesting fact, which may now be considered fully proved, is that, when Vedalia has completely cleared a district of Icerya, and has itself apparently completely died out, Icerya will return in force after awhile, and Vedalia will also revive and again destroy it. The last instance of this has occurred at Napier, in May. Both insects have

now, for some years, been looked upon as extinct at Napier, but Icerya having appeared at Wellington (the capital), the government have directed Mr. Wight to procure the inevitable *Vedalia cardinalis*, and he finds that it is to be had again at Napier in such numbers that, to use Mr. Commissioner Harding's expression, as many can now be procured by a good collector as Mr. Koebele obtained, in the same time. Mr. Koebele caught 6,000 in three days, and, even considering that Mr. Koebele is a most exceptionally good collector, there does not seem much fear of the useful little insects becoming extinct. A very long experience, and much close observation of these two insects, enabled Mr. Wight to observe some interesting and useful facts connected with them. On one occasion, when he was engaged for several weeks among them, collecting and taking notes, he found a wide, straggling hedge of *Acacia undulata*, several miles long, at one end of which a very few Vedalia had been introduced and had increased at a rate that he would not like to ask anyone to believe. Where they had first been liberated all the scales were gone and all the ovisacs empty; in some cases the mother scale had died naturally and the young larvæ escaped, but nearer, where the invading army had swept on, it was observable that in nearly every ovisac which had been plundered there still remained a very few of the eggs, these being invariably situated under the body of the scale mother, and, instead of being merely covered by the cottony ovisac, were imbedded in the fluff. These eggs being spared accounts for the survival of the pest, and the reason of their being spared was afterwards explained when some hungry Vedalia were offered Dactylopius scales and could not eat them because the fluff entangled their jaws. It was also observed that where there were patches of untouched ovisacs the female Vedalia laid eggs, either touching the terminal portion of the covering or slightly lifted it and inserted them under it. The idea occurred to Mr. Wight that in this way the Vedalia had most probably been introduced naturally into New Zealand, and, acting upon it, he collected some of these impregnated ovisacs (a tedious process), and also increased the number by confining impregnated female beetles, and tried the experiment of shipping them to the Cape of Good Hope, where they fortunately arrived alive and had the honor of being the first live Vedalia introduced into that country (April, 1892). The circumstance is mentioned here, as it may be a useful hint to the entomologists wishing to send live Vedalia to a great distance, in a hot climate, which is not a very easy thing to do successfully.

This paper was briefly discussed by Mr. Riley.

The following paper was then read:

NOTES ON SOME INSECT PESTS OF TRINIDAD, BRITISH WEST INDIES.

By F. W. URICH, *Trinidad.*

[Read, in the author's absence, by J. B. Smith.]

In treating of the insect pests of Trinidad we must divide them into two groups, viz: The garden pests, which make themselves felt principally during the dry season (January to April), and the agricultural pests, which are more numerous during the rainy season, which is so conducive to the development of insects. In fact, an entomologist's season lasts as long as it rains, which in Trinidad is from May or June to December, and sometimes longer. With the luxuriant vegetation we have here, unless the insect attacks are very severe they do not seem to attract any attention from the inhabitants. This apathy is most detrimental to our gardens, for the constitutions of many valuable plants are weakened and they fall easy victims the minute the pests get the upper hand.

For the names of most of the insects referred to I am indebted to Prof. C. V. Riley. Mr. T. D. A. Cockerell kindly gave me the names of the Coccidæ.

Amongst the garden pests the Coccidæ are most conspicuous, and seem to thrive best during the dry season. I have collected about twenty species, all from different gardens about Port of Spain and St. Anns, a description of which will be published elsewhere by Mr. T. D. A. Cockerell, and no doubt some more will turn up in the course of time. The commonest Coccid in the gardens is the *Orthesia insignis* Dgl. which seems to have a great liking for Crotons, Eranthemum, and other decorative foliage plants. I do not think that I shall be making a bold assertion in saying that there is hardly a garden in this island in which this insect does not occur. A *Lecanium* sp. found principally on Hibiscus and *Lecanium hemisphœricum*, are also pretty common about the gardens, doing considerable damage. The following genera of Coccidæ are represented about the gardens sometimes by several species:

Aspidiotus.	*Vinsonia.*
Asterolecanium.	*Ischnaspis.*
Chionaspis.	*Pinnaspis.*
Lecanium.	*Orthesia.*
Mytilaspis.	*Icerya.*
Pulvinaria.	*Planchonia.*

As far as the other genera of the Hemiptera are concerned *Siphonophora* sp. ? near *glauca*, Buckley and an *Aphis* sp. are well represented, but seem to disappear as soon as the rainy season sets in. *Cerataphis lataniæ* is not very rare and spoils many a pretty palm about the gardens. A Tingitid, *Corythuca* near *ciliata*, also found on the castor bean, seems to have a liking for Dahlias, leaves of which plant it soon

causes to wither. All these garden pests are well kept in check by their natural enemies, many of which can be seen on the different plants. There are many *Brachyacantha ursina* and allied species, and the black carcasses of the Aphides with a small hole at one end of their bodies tell us that the *Ephedrus incompletus* Prov. has found them fit subjects for depositing their eggs in. The Coccidæ also show parasite holes on their scales. A *Chrysopa* sp. is quite common here and is always found together with the *Orthesia* on Crotons.

In our garden at Port of Spain we keep a little Cyprinodonte? sp. about 1 inch in length. This little fish is found commonly all over the island and I am sending specimens to Prof. C. V. Riley to show to the members of the Association. His use is to keep down the mosquito larvæ in the water tanks, etc. I think this little fish could be introduced into America with comparatively little trouble, as he is very hardy, standing a degree of heat which would kill most fishes; besides this it is viviparous, so that a few put into a water tank would increase without giving any trouble at all.

Amongst the agricultural pests the first place is taken by the leaf-cutting ants (*Atta sexdens* L.), which is the worst enemy of the cocoa plantations. It is found all over the island. The average size of a colony of these ants is 1 cubic foot. A nest, as it may be called, consists of a number of these colonies near each other, and connected by subterranean galleries. The largest nest I have seen covered an area of about 2,500 square feet, and must have contained hundreds of colonies, each of which possessed a queen. The colonies produce hundreds of females yearly, which, as soon as the rainy season sets in (about May and June), swarm, and a certain proportion of them form new colonies. The damage these ants do to young cocoa trees is a source of perpetual anxiety to the planters, who spend large sums yearly to have the nests destroyed. The method adopted to destroy these ants consists in "puddling" them, to use the local expression. This process consists in digging up the nests, adding plenty of water, and then mixing up the ants with the mud, so as to stifle them, and form a concrete mass. There are some other remedies used, such as coal tar and cyanide of potassium, but they are not attended with good results.

A Longicorn beetle (*Stirastoma depressum*) also attacks the cocoa trees, preferring the young ones. In some localities it is on the increase. The tree this beetle attacks in the woods by preference is the *Pachira aquatica*.

Generally, every year at about the commencement of the rainy season, swarms of locusts, belonging to the Acridiidæ, suddenly make their appearance, and commence attacking the cultivations. The fact of the insects being all young tends to show that they are hatched from eggs of the year before. They are generally destroyed, so that the numbers are well kept in check.

At the present moment the Coccid, *Diaspis boisduvallii*, is making its

presence felt at Cedros (south coast of Trinidad) in the cocoanut estates. There are about 20 acres, equal to about 1,400 trees, attacked. At the same time the Palm Weevil (*Rhynchophorus palmarum* Linn.) has made its appearance there, up to now in few numbers, but it may increase in time. It is likely that the Coccids are the cause of the weevils' attacks, for, as far as my experience goes, this beetle likes diseased trees.

The cane-borer, *Xyleborus perforans*, which caused so much damage to the sugar planters last year, has not done any damage to speak of this year, although it has not disappeared from the cane-fields altogether, and might increase in numbers as soon as favorable conditions occur.

In concluding these brief notes I would like to call attention to the good services the hunting ants, Eciton, render the Trinidad agriculturists. Up to the present I have observed two species in Trinidad, the most conspicuous of which is *Eciton Forelii* Mayr. Most travelers in tropical regions represent this ant as a most ferocious insect, not even sparing man. The good they do to cocoa estates in clearing away vermin is invaluable, for they are the sworn enemies of everything which creeps and crawls, and which they tear to pieces and devour without mercy, but they do not attack man if he is not the aggressor, as will be seen from the following lines taken from a letter received from Mr. A. B. Carr, of Caparo:

"The other night I was suddenly awakened by something crawling over my face. Catching some insect I crushed it, and from the smell it emitted I knew at once that it was a hunting ant. At the same time I heard the peculiar clicking noise the hundreds of legs make when hurrying about in quest of food. Although it was not quite convenient, I left the house and sought shelter at a neighbor's, knowing well that all vermin would be soon cleared out. It is remarkable that they did not attack me while asleep, although when we interrupt their columns in the woods we are furiously attacked. It is a pity that these ants do not usually attack large nests of the Atta, although I have already seen them plundering a small colony."

The following paper was then read:

NOTE ON SLIP-RECORDS.

By T. D. A. COCKERELL, *Las Cruces, N. Mex.*

[Read, in the author's absence, by H. Garman.]

It has occurred to me that the present is a suitable occasion for bringing forward a suggestion, which I have long intended to make, as to slip-records.

Every entomologist in the course of his work makes numerous notes on which he bases his published papers. But when he dies, or gives

up the study of entomology, he usually leaves a considerable amount of fragmentary unpublished matter, which is very likely to be wasted. If he has been a careful worker, he is sure to have made descriptions of larvæ which he could not rear, incomplete notes on habits, distribution, etc., and other observations which are valuable and yet too incomplete for publication. He will also have made many notes which could hardly be published as separate items, and yet would be very useful in the preparation of faunal or monographic works. He will probably have hoped to make use of all these notes in publication himself, sooner or later, but he is exceptional if he can complete his projected labors before he dies.

The great difficulty of dealing with the scattered manuscripts of a deceased naturalist, unless he has been unusually methodical, has often been alluded to by writers; and the suggestion I have to make is that in future, so far as possible, entomological notes be kept on a uniform plan, so as to make it easy to preserve and consult them, and to incorporate notes by various authors in a single series.

In order to do this, we can hardly adopt a better method than that of slip-records. The slips should be of uniform size, although the paper or card they are made of may vary according to the taste of the individual. For myself, I prefer paper to card, as being both cheaper and less weighty to carry about. But the point of importance is the size, as the essence of the scheme now proposed is that all notes should be capable of being incorporated in a single series, or notes from various authors on a single subject in a series. I inclose herewith a slip of the kind used by Mr. C. D. Sherborn in his great index of the genera and species of animals, now in progress at the Natural History Museum in London. Both as to size and paper it seems to me very suitable, and slips of this sort are extremely cheap.

I therefore suggest to this association that all slip-records be kept on slips $2\frac{1}{2}$ x 5 inches.

Now, as to the manner of writing the notes, the inclosed specimen shows the method I have adopted.

When a specimen is entered it receives a number—in the present case 178. Before the number I write "Ckll.," being an abbreviation of the recorder's name. Each recorder should adopt an abbreviation of his name which can be easily recognized, or else write his name in full before the number, so that when his notes are incorporated with others there may be no mistake as to who wrote them.

After the number follows locality, date, and any necessary particulars.

Two species should never be put on one note, unless it is a reference to a second species in connection with that to which the note refers, as *Lycæna marina* in the note sent.

When the notes are written they should be kept in a series, according to their numbers, until the names of the species are ascertained. When

a species is identified the name is written in a space left at the top of the note, and the note is transferred to its place (in alphabetical order) in the group to which it belongs. The name of the authority for the identification of the species should appear in square brackets after the name of the nomenclator, thus, in the note sent: *Monedula pulchella*, Cr. [Fox].

Not rarely it is necessary to use large sheets of paper for extended notes, and especially drawings. These should be preserved separately and indexed by notes of the usual kind placed in the regular series.

Had this method been pursued in the past we might have been able to consult in one series, in a public museum or library, the notes of Say, Harris, Fitch, Leconte, and many others. Imagine the value and interest of such a collection! Imagine the numerous little facts, hints, and suggestions they might have left us which are nowhere to be found in their published writings! And if the notes contained nothing that was not published, how great the advantage of a complete index to their voluminous writings! Such a collection of slip-records would be one of the most valuable possessions of a public library or museum, and care would have to be taken that it was used with discretion and preserved intact.

I have alluded to this method as offering a means of preserving conveniently the manuscripts of those who die; but it has great value during the lifetime of the recorder. I had such a slip-index in Jamaica, and found it so useful that I would never now be without one. I left it in the Jamaica Museum for my successor, and have commenced a new series for the New Mexico Agricultural College.

Further, it permits the ready tranference of records. I often receive (and, I trust, send) valuable bits of information in letters. All this I have to copy out on slips; but what a saving of labor to all parties if it was *sent* on slips, which could be incorporated in the series just as received! Moreover, suppose an author of repute is preparing a monograph. We are all delighted to help him by transmitting our observations on his group, but often the labor of copying them out is very great. By the slip method, we could just send him our slips; he could put them in his series until the monograph was done, and then, if desired, return them to their owners. Therefore, I commend this matter of slip-records to your consideration, and urge you to decide what should be done about it.

Mr. Hopkins, in the discussion following this paper, said he used the system advocated in the paper; that he kept a box of the slips constantly on his table, but that he preferred a larger slip as holding more and as affording room for sketches.

Mr. Summers suggested the standard library card as preferable to that used by Mr. Cockerell.

Mr. Osborn agreed with Mr. Summers.

The association then, on resolution, adjourned to meet at such time and place as may be decided upon by the executive officers.

H. Garman,
Secretary.

DIPTEROUS PARASITES IN THEIR RELATION TO ECONOMIC ENTOMOLOGY.*

By C. H. Tyler Townsend, *Kingston, Jamaica.*

It is a patent fact that no insect parasites of insects occur in the large series of orders known as the Ametabola, or those with an incomplete metamorphosis. They are to be found only in the series Metabola, or those orders which undergo a complete metamorphosis, and within this series they are confined to three orders. Certain predatory forms occur in the Neuroptera (as restricted) and the Lepidoptera, but the only orders containing true parasites of insects are the Coleoptera, Hymenoptera, and Diptera. It is, therefore, evident that parasitism on insects is a perquisite of the higher and more developed orders, and usually, within these orders, of the higher and more specialized groups. Moreover, the higher the order, the greater is the percentage of parasitism which it contains. The Coleoptera contains an extremely small percentage, belonging to about four small families. The Hymenoptera contains a large percentage, distributed, however, through but a half dozen or so of families, and comprising mostly very small parasites. The Diptera contains probably the greatest percentage, distributed through about seventeen families.

Still another point remains to be noticed, and that is the diversity of the parasitism, or the number of orders upon which each of the three named is parasitic. Of the sixteen orders of insects, as evolved by Brauer and now generally accepted, only five are subject to parasitism. These are the Orthoptera, Hemiptera, Coleoptera, Lepidoptera, and Hymenoptera. The parasitic Coleoptera are confined in their attacks to the first and last of these. The Hymenoptera attack the last four, including their own order. The Diptera, however, furnish parasites upon all five of these orders.

Last of all, two significant facts strike us: First, that the Diptera themselves are not attacked by any parasites, not even by members of their own order, if we may except a species of Phora which is said to destroy the larvæ of the Silk-worm Tachinid in India. There is no reason, however, for believing that this is a true parasite. While the Coleoptera are subject to parasitism from the Hymenoptera and Diptera, the Hymenoptera are subject to attack from all three (including

* This paper reached me too late for presentation at the Madison meeting.—H. G.

their own order), but the Diptera are exempt, at least it is safe to say comparatively so, from true parasitic attack. The second and final significant fact is that the Diptera are the only order of insects which has become truly parasitic (endoparasitic) on mammals, including man himself. This fact of the dipterous parasitism on Mammalia seems the most remarkable and striking of all.

Of these three parasitic orders, our subject deals with the last named, the Diptera, and more particularly with the parasitic members of the order in their economic relations. It has been noted that the Diptera afford the most generally distributed amount of parasitism, covering the entire field of orders subject to parasitic attack. Let us separately consider the families of Diptera which contain parasitic members.

(1) *Cecidomyiidæ*.—A number of cecidomyians are known to be parasitic on Coccidæ and Aphides. Prof. J. H. Comstock found a Diplosis in California parasitic on Coccids. Mr. T. D. A. Cockerell has found a similar parasitic species in Jamaica. A number of other cases had been previously recorded, and they apparently all belong to the genus Diplosis, though one is referred to Cecidomyia. The parasitism in this family, comprising as it does the only cases in the Nemocerous Diptera, is extremely interesting, since the Nemocera are the most ancient living forms of Diptera. It should be noted also that the parasitism here is confined to a few members of a single genus. About eight North American genera are known, some being very numerous in species.

(2) *Nemestrinidæ*.—Two North American genera are known. The genus Hirmoneura is recorded as parasitic on wood-boring coleopterous larvæ. A European species is said to deposit its eggs in the burrows of a buprestid, to which the larvæ attach themselves by means of hooks on the segments, but later lose the hooks and become parasitic on a secondary host, a beetle of the genus Rhizotrogus.

(3) *Bombyliidæ*.—In this family over thirty North American genera occur. These flies are all, so far as known, parasitic on insects of the orders Lepidoptera and Hymenoptera. There is only the exception that the larvæ of Aphœbantus and Systœchus have been found to feed on the eggs of locusts. It is the peculiar habit of this family to attack insects which live underground, such as certain bees and wasps, and cutworms.

(4) *Acroceridæ*.—About eight North American genera are known, The larvæ are, so far as known, parasitic on spiders and their egg-masses. It is worthy of note that this is the only dipterous family parasitic on spiders.

(5) *Conopidæ*.—This is another family which contains purely parasitic species. Seven North American genera occur. All are parasitic, without known exception, upon Hymenoptera and Orthoptera, principally upon bees and wasps, whose appearance they have acquired.

(6) *Pipunculidæ*.—The larvæ of some species of the single genus Pipunculus are known to be parasitic on homopterous insects of the family Jassidæ.

(7) *Oestridæ.*—None of these flies attack insects or any invertebrates, but are without exception parasitic on mammals. They are of much economic importance, but unlike the other families of parasitic Diptera, they are highly injurious on account of the hosts which they infest. Nearly all of our domestic animals, and man himself, are liable to their attack. Seven North American genera are known.

(8) *Phasiidæ.*—Seven North American genera are known. All are parasitic, without known exception, on Orthoptera, Hemiptera, and Coleoptera (locusts, Pentatomids, Coreids, and a beetle).

(9) *Gymnosomatidæ.*—Two genera occur in North America. They are parasitic on Hemiptera and Lepidoptera. The species attack Pentatomids, and Cistogaster has been bred from Leucania.

(10) *Ocypteridæ.*—Seven genera are known in North America. They are parasitic, so far as known, on Orthoptera, Hemiptera, Coleoptera, and Lepidoptera (locusts, Pentatoma, Cassida, Leucania).

(11) *Phaniidæ.*—Two North American genera occur. So far, they have been found parasitic only on Coleoptera.

(12) *Tachinidæ* s. str.—Over one hundred and twenty genera are known in North America. These, without any known exception, are all parasitic on insects of the orders Orthoptera, Coleoptera, Lepidoptera, Hymenoptera, but more particularly on Lepidopterous larvæ. This family is preëminently parasitic on Lepidopterous larvæ. Hundreds of species exist, which destroy immense numbers of them annually. The Tachinidæ, from this fact, are perhaps the most important group of beneficial insects which exists.

(13) *Dexiidæ.*—Over forty North America genera are known. These are parasitic, so far as recorded, on Orthoptera, Coleoptera, and Lepidoptera. A Dexiid has also been bred from a scorpion, and from snails.

(14) *Sarcophagidæ.*—About seven genera are known in North America. The Sarcophagids are largely creophagous, and also coprophagous, but some species are occasionally parasitic on Orthoptera, Coleoptera, and Lepidoptera. Phrissopoda has been bred from Lepidopterous larvæ, and from snails. Sarcophaga has been bred from all three orders. Sarcophaga has likewise been bred from snails, and a species is also parasitic beneath the skin of turtles.

(15) *Muscidæ* s. str.—About sixteen North American genera are known. These flies are largely coprophagous and creophagous, but some species have been bred from lepidopterous larvæ. A Lucilia has been found parasitic on toads.

(16) *Anthomyiidæ.*—Twenty-one North American genera occur. Some species are occasionally parasitic on Orthoptera, and some other insects.

(17) *Ochthiphilidæ.*—So far as known, these acalyptrate Muscids, of which there are two genera in North America (one introduced from Australia) are parasitic on Aphids and Coccids. It is noteworthy that the Cecidomyiidæ and this family furnish the only parasites of Aphids and Coccids among the Diptera.

If, as has already been referred to, *Phora cleghorni* is truly para, sitic on the Silkworm Tachinid of India (*Trycolyga bombycis*), this would add another parasitic family to the Diptera, the Phoridæ. Moreover, it would mark a very striking deviation in the parasitism of the order. Four genera of Phoridæ are known in North America. The larvæ usually feed on dead snails, insects, and fungi, or are necrophagous.

Reviewing these families, we find that only two out of the seventeen can be classed as actually injurious. The Acroceridæ are parasitic on spiders, which latter are on the whole beneficial insects. The second family, the Oestridæ, are highly injurious.

The Conopidæ and Bombyliidæ, in so far as they destroy wild bees, including the humble bees, might be considered somewhat injurious, from the fact that the humble bees are of use in the fertilization of certain flowers, notably red clover. These two families contain about the only known dipterous parasites of bees. Four families are only partly parasitic in their habits. They are the Cecidomyiidæ, Sarcophagidæ, Muscidæ, and Anthomyiidæ. Such members of them as are parasitic destroy injurious insects.

The remaining families, the Conopidæ and Bombyliidæ being included-are practically without exception parasitic or injurious insects, if we may include the Dexiidæ, which accidentally and rarely diverge from these habits. These make eleven families, the genera in which sum up more than 225 in North America. Four or five species to each genus is a low estimate, making fully 1,000 North American species. It should be noted that these flies are practically without enemies, and therefore increase rapidly. This accounts for their great abundance, both in individuals and species, especially in the Tachinidæ. It can readily be imagined, therefore, that their agency in the destruction of injurious insects is of paramount importance.

REVISED LIST OF MEMBERS OF THE ASSOCIATION OF ECONOMIC ENTOMOLOGISTS.

AMERICAN MEMBERS.

J. M. Aldrich, Moscow, Idaho.
William B. Alwood, Blacksburg, Va.
William H. Ashmead, Department Agriculture, Washington, D. C.
George F. Atkinson, Ithaca, N. Y.
C. F. Baker, Fort Collins, Colo.
M. H. Beckwith, Newark, Del.
Charles J. S. Bethune, Port Hope, Ontario, Can.
Lawrence Bruner, West Point, Nebr.
John P. Campbell, Athens, Ga.
F. H. Chittenden, Department Agriculture, Washington, D. C.
T. D. A. Cockerell, Las Cruces, N. Mex.
J. H. Comstock, Ithaca, N. Y.
A. J. Cook, Agricultural College, Mich.
D. W. Coquillett, Los Angeles, Cal.
A. B. Cordley, Pinckney, Mich.
G. C. Davis, Agricultural College, Mich.
E. W. Doran, Buffalo Gap, Tex.
C. H. Fernald, Amherst, Mass.
James Fletcher, Ottawa, Ontario, Can.
S. A. Forbes, Champaign, Ill.
H. Garman, Lexington, Ky.
C. P. Gillette, Fort Collins, Colo.
F. W. Goding, Rutland, Ill.
H. A. Gossard, Ames, Iowa.
C. W. Hargitt, Syracuse, N. Y.
Charles A. Hart, Champaign, Ill.
F. L. Harvey, Orono, Me.
F. H. Hillman, Reno, Nev.
A. D. Hopkins, Morgantown, W. Va.
L. O. Howard, Department Agriculture, Washington, D. C.
Geo. H. Hudson, Plattsburg, N. Y.
Geo. D. Hulst, 15 Himrod street, Brooklyn, N. Y.
D. S. Kellicott, Columbus, Ohio.
J. A. Lintner, State House, Albany, N.Y.
Otto Lugger, St. Anthony Park, Minn.
B. Pickman Mann, Patent Office, Washton, D. C.
C. L. Marlatt, Department Agriculture, Washington, D. C.
John Martin, Champaign, Ill.
H. A. Morgan, Baton Rouge, La.
Mary E. Murtfeldt, Kirkwood, Mo.
F. J. Niswander, Laramie, Wyo.
Herbert Osborn, Ames, Iowa.
A. S. Packard, Providence, R. I.
Theo. Pergande, Department Agriculture, Washington, D. C.
C. H. Perkins, Burlington, Vt.
E. A. Popenoe, Manhattan, Kans.
E. Baynes Reed, Esquimault, B. C.
C. V. Riley, Department Agriculture, Washington, D. C.
P. H. Rolfs, Lake City, Fla.
M. V. Slingerland, Ithaca, N. Y.
John B. Smith, New Brunswick, N. J.
F. H. Snow, Lawrence, Kans.
E. B. Southwick, Central Park, New York City.
J. M. Stedman, Auburn, Ala.
James Stimson, Watsonville, Cal.
H. E. Summers, Champaign, Ill.
Roland Thaxter, Cambridge, Mass.
J. W. Toumey, Tuscon, Ariz.
F. L. Washburn, Corvallis, Oregon.
F. M. Webster, Wooster, Ohio.
Clarence M. Weed, Durham, N. H.
H. E. Weed, Agricultural College, Miss.
E. V. Wilcox, Cambridge, Mass.
C. W. Woodworth, Berkeley, Cal.

FOREIGN MEMBERS.

E. C. Cotes, Indian Museum, Calcutta, British India.
Charles French, Government Building, Melbourne, Australia.
Eleanor A. Ormerod, Torrington House, St. Albans, England.
A Sidney Olliff, Australian Museum, Sidney, N. S. W.
Arthur E. Shipley, Cambridge, England.
W. M. Schöyen, Christiania, Norway.
C. H. Tyler Townsend, Kingston, Jamaica, B. W. I.
Edward H. Thompson, Hobartown, Tasmania.
H. Tryon, Brisbane, Queensland.
R. Allan Wight, Paeroa, Auckland, New Zealand.

ENTOMOLOGICAL SOCIETY OF WASHINGTON.

October 5, 1893.—Mr. R. S. Lull, of the Maryland Agricultural College, was elected an active member. Messrs. W. D. Doan, of Coatesville, Pa.; J. L. Healey, of Rogers Park, Ill.; H. C. Fall, of Pomona, Cal.; H. F. Wickham, of Iowa City, Iowa; and L. W. Mengel, of Lancaster, Pa., were elected corresponding members.

Mr. Schwarz gave some additions to the list of North American termitophilous and myrmecophilous Coleoptera. Discussed by Messrs. Riley and Schwarz.

Mr. Marlatt read a paper on the neuration of the wings of Tenthredinidae, proposing a system of nomenclature of the veins, following closely that of Cameron and André, with a few minor changes. Discussed by Messrs. Ashmead, Riley, and Howard.

Mr. Hopkins presented some short notes upon certain wood-boring beetles, exhibiting drawings of the species. Tho forms mentioned were *Hylecoetus lugubris* from chestnut, *Serropalpus striatus* from black spruce, and *Eupsalis minuta* from oak, and an unknown Coleopterous larva injuring oak and chestnut. Discussed by Messrs. Schwarz and Riley.

C. L. Marlatt,
Recording Secretary.

November 2, 1893.—Mr. Heideman presented a design for a seal for the society, which was adopted.

Prof. Riley presented some "Remarks upon Belostoma" in which he gave a careful review of the synonymy of *Belostoma americanum* and *Benacus griseus*, indicating the structural differences between them based upon careful dissections. Discussed by Dr. Gill, Messrs. Schwarz, Ashmead, Heideman, and Howard. Prof. Riley read a second paper entitled "Remarks on the eggs of Ceresa" showing that his early figure of the egg punctures of a species which he called *C. bubalus* were in reality the punctures of *C. taurina* of Fitch, while the figure published by Marlatt and other western entomologists represents the true puncture of *C. bubalus*. Discussed by Mr. Ashmead, who pointed out the availability of the structure of the last ventral segment as a classificatory character in this genus. A discussion upon the use of the genitalia in classification followed, which was participated in by Drs. Gill Stiles, and Riley and Messrs. Ashmead and Schwarz. Dr. Riley read a third paper entitled "Notes from 'Sunbury'" in which he presented specimens of injury which conclusively showed that *Chrysobothris femorata* goes through all its transformations in less than a year and that *Trochilium syringæ* passes from the egg to the adult in Washington in at least three months.

Mr. Schwarz exhibited a Pterostichus the elytra of which were covered with a growth of some species of Laboulbeniaceae.

Mr. Ashmead showed a Floridian specimen of the Fulgorid African genus Amplicotes and said that he was familiar with a case in which a hymenopterous genus occurs both in Africa and in Florida, but not elsewhere.

Mr. Schwarz stated that the Halticid genus Argopistes has this same distribution.

Mr. Heidemann exhibited a new genus and two new species of Capsidae found near Washington.

Dr. Gill exhibited the cocoon of a species of Phydippus found in a bunch of grapes.

L. O. Howard,
Recording Secretary, pro tem.

o

U. S. DEPARTMENT OF AGRICULTURE.

DIVISION OF ENTOMOLOGY.

PERIODICAL BULLETIN. Issued February, 1894.

Vol. VI. No. 3.

INSECT LIFE.

DEVOTED TO THE ECONOMY AND LIFE-HABITS OF INSECTS, ESPECIALLY IN THEIR RELATIONS TO AGRICULTURE.

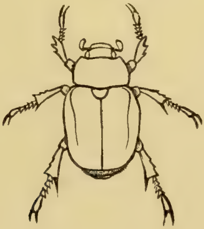
EDITED BY

C. V. RILEY, Entomologist,

AND

L. O. HOWARD, First Assistant,

WITH THE ASSISTANCE OF OTHER MEMBERS OF THE DIVISIONAL FORCE.



[PUBLISHED BY AUTHORITY OF THE SECRETARY OF AGRICULTURE.]

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1894.

CONTENTS.

SPECIAL NOTES.

Quarantine against injurious Insects.—At the Fruit-growers' Convention, held at Los Angeles, Cal., recently, an important paper, entitled "Suggestions on Quarantine," was read by Mr. Alexander Craw. The importance of effective quarantine was elaborated in connection with a brief review of the history of fruit-growing in California. It was shown that California is now importing fruits, trees, shrubs, plants, and seeds from Europe, Australia, China, Japan, South Sea Islands, South and Central America, and other localities, and that hardly a vessel arrives in the west coast ports which does not bring such objects, many of which are infested with some insect or fungus pest. The present quarantine regulations of California have been formulatedby the State Board of Horticulture, under the authority of the act organizing the Board. The first and, perhaps, the most necessary of these regulations reads as follows: "All consignees, agents, or other persons shall, within twenty-four hours, notify the Local Inspector or Quarantine Guardian of the arrival of any trees, plants, buds, seeds, pits, or scions at the first point of debarkation in the State of California." This regulation, as Mr. Craw points out, is a very good one, but fails of its effect for the reason that no penalty is attached to its violation. It is, therefore, ineffective, and throws the entire burden of discovery upon the vigilance of the local inspectors. At the Cape of Good Hope, however, a quarantine law is in operation giving the Governor power to provide by proclamation for protection against the importation and spread of pests, and providing a penalty for its contravention in a fine not exceeding five hundred pounds sterling, with the alternative of imprisonment at hard labor not to exceed two years. This law, if enforced, will certainly prove efficient, and Mr. Craw recommends the adoption of similar legislation in California.

He also advises the erection of fumigating houses at such railroad stations as receive shipments of fruit trees and fruit packages. These stations should be provided with facilities for retaining the infested stock until the local inspector can assure himself that it is free from dangerous pests. The opinion of Judge McKinley upon the validity

of the California quarantine laws is quoted nearly in full. It will be remembered that this decision was rendered in the case brought by the State Board of Horticulture against the owners of certain orange trees which were imported from Tahiti and which were infested by a scale insect new to California. We have already referred to this case and to Judge McKinley's decision upon page 400, Vol. IV, INSECT LIFE. So far as we know, California took the lead in regard to this matter of quarantine, and if this State succeeds in making its measures in this direction effective, it will deserve the gratitude of the fruit-growers of the entire country. The importance of such regulations in certain other States can hardly be overestimated, and Florida in particular needs some such quarantine law.

There are a number of enterprising horticulturists in Florida at the present time who are engaged in attempting to acclimate many subtropical plants of economic importance. We know already of several West Indian insects which have been brought into this country in this way and there are undoubtedly many more which should be guarded against. Florida will not be the only sufferer through negligence in this respect since, although her climate differs from that of the more northern States and the West Indian and South and Central American species imported will in many cases not spread to the northward, there are still a number of species, particularly among the scale-insects, which, though tropical or subtropical in origin, are potential pests of temperate regions as well. The whole country, therefore, is more or less interested in this question, and there can be no better illustrations of this fact than the recent occurrence of the pernicious San José Scale around Charlottesville, Va., and the likewise comparatively recent distribution of a West Indian Aspidiotus on Peach (*Aspidiotus lanatus*) which we have deemed of sufficient importance to treat of in our annual report for the year 1893.

Some Kansas Insect Notes.—In the Transactions of the Kansas Academy of Science (Vol. XIII, 1891–'92, pp. 112–115), Mr. Vernon L. Kellogg publishes some notes on injurious insects which will be of interest to economic entomologists. The species considered are the Wheat-straw Worm (*Isosoma tritici*), a new Bibio (*Bibio tristis* n. sp.), the Western Corn Root-worm (*Diabrotica longicornis*), the Ham Fly (*Piophila casei*), and the Fermenting Fruit-fly (*Drosophila* spp.). Mr. Kellogg shows that the Wheat-straw Worm occurred in about one-fourth of the counties of the State of Kansas in 1891 and was especially prevalent in central and western Kansas. The author, perhaps unwittingly, gives a wrong impression concerning the life history of this species in leading to the inference that it is single-brooded. No reference is made to its important dimorphism. Parasitism by *Eupelmus allynii* was noticed in all of the examinations made. The new Bibio

was abundant in many wheat fields, but no damage was positively traced to it. A great deal of damage in a packing house in Kansas City by the Ham Fly was reported in 1891; $1,500 worth of spoiled meats were returned in one week. Mr. Kellogg's breeding cage notes give the duration of the egg-state in this species as four days, the larval state about two weeks, and the pupal state one week, while the adult flies live from six days to two weeks. These observations hardly agree with those of Miss Murtfeldt, reported upon pp. 173, 174 of the last number of INSECT LIFE. Instead of four days she found the egg to hatch within thirty-six hours, while the larva, according to observations, completed its growth in from seven to eight days instead of in two weeks as reported by Mr. Kellogg. The average duration of the life of the adult she found did not exceed a week. All of which simply shows the variability in these respects of the same species, even where the conditions are substantially similar.

Papers on Iowa Insects.—We have just received from Prof. H. Osborn a brochure entitled "Papers on Iowa Insects, consisting of Fruit and Forest Tree Insects (reprinted from the Trans. State Horticultural Society, 1892) and Some Iowa Farm Insects (reprinted from the Report of the State Agricultural Society, 1892)." The little pamphlet consists of a series of condensed and well-illustrated articles upon the different insects which Prof. Osborn has found injurious in the State of Iowa in his many years experience as professor of zoology and entomology in the State Agricultural College, as entomologist to the State Experiment Station, and as a field agent of this Division. The matter is presented in attractive form and is to some extent a compendium of the subject which will be found extremely useful to Iowa farmers and fruitgrowers. It covers 64 pages, closely printed brevier matter. The illustrations are nearly all borrowed, but are carefully accredited.

Recent Entomological Publications of the New Jersey Experiment Station.—Since we last noticed the publications of this Station, Prof. J. B. Smith has sent us Bulletins 94 and 95 and his Annual Report. Bulletin 94 is a consideration of the insects injurious to Cucurbs. The insects treated are the Boreal Ladybird (*Epilachna borealis*), the Striped Cucumber-beetle (*Diabrotica vittata*), the Squash Bug (*Anasa tristis*), the Melon Louse (*Aphis cucumeris*), and the Squash Borer (*Melittia ceto*). Like most of Prof. Smith's bulletins, this contains a number of original observations, and he seems to have followed out the life history of each insect for himself. The Squash Bug, ordinarily so difficult to fight, he proposes to treat by raking up and destroying a great major-

ity of the vines as soon as the crop is off, the object being to destroy all eggs and young on the vines and force the adults to other localities for food or shelter. The few plants left for seed can then be easily looked over and the insects handpicked. Handpick ng in the early spring is also recommended. He has not ascertained the method of hibernation of the Melon Louse, but advocates the early search for the first individuals in June, when they should be handpicked and destroyed. Later he urges underspraying with kerosene emulsion. The bulletin contains a number of new figures, mainly prepared from photographs, which, while indicating general appearance and character of damage, are otherwise worthless. Bulletin 95 is a short compiled account of the Periodical Cicada. The Annual Report gives an account of the work done during the year and repeats much of the information given in the bulletins. If we have noticed Prof. Smith's station bulletins more often than those of other station entomologists, it is because he is one of the most prolific writers, and because, on the whole, he is doing some of the best and most original work.

The Four-lined Leaf-bug.*—In this bulletin Mr. M. V. Slingerland gives an elaborate account of *Pœcilocapsus lineatus*, showing that this leaf-bug has been very injurious recently to the foliage of currant and raspberry bushes in the State of New York. The author gives an elaborate account of the past history, destructiveness, and distribution of the pest, a lengthy list of its food-plants, an account of the insect's appearance and indications of its presence, classification, life history, and remedies, followed by bibliography and synonomy, the whole account covering something over 30 pages and illustrated by 13 text figures. The most interesting portion of the bulletin is the announcement that the species passes nine months of the year in the egg state and that the eggs are deposited in slits cut lengthwise into the stems of plants, extending through the bark-wood and nearly half way through the pith. In each of these slits from two to fourteen eggs are deposited. The insect is single-brooded in New York State. The remedies recommended are kerosene emulsion for the nymphs, destruction of the eggs by pruning, and the capture of the nymphs and adults by jarring into receptacles, where they are destroyed. The bulletin is among the most commendable of those which come to us and well illustrates the author's care and thoroughness, as well as his ability as an observer, though it may be questioned whether so much technical detail were not better relegated to publications addressed to specialists than included in those addressed ostensibly to farmers.

*Bulletin 58, Cornell University Agricultural Experiment Station, Entomological Division, Ithaca, N. Y., October, 1893.

Insects Injurious to Celery.—Mr. G. C. Davis, consulting zoologist to the Michigan Agricultural Experiment Station, has just published as Bulletin 102 of that Station, an interesting report on insects injurious to celery in Michigan. A number of species not heretofore recorded as celery enemies receive treatment, among them several species of true locusts, several leaf-hoppers, the Tarnished Plant-bug (*Lygus pratensis*), the Flea-like Negro-bug (*Corimelæna pulicaria*), the Three-lined Thrip (*Coleothrips trifasciata*), the Celery Plant-louse (*Rhopalosiphum dianthi*), several Flea-beetles, the larva of *Papilio asterias*, the Spotted Cut-worm (*Agrotis C-nigrum*), the Celery Borer (*Phlyctænia ferrugalis*), and four Tortricids, viz, *Dichelia sulfureana*, *Sericoris bipartitana*, *Cacœcia rosaceana*, and *Tortrix pallorana*. Life histories of the insects where known are given, and the principal remedies consist in the use of "hopperdozers" and "hopperettes," two convenient styles of which are illustrated, the use of carbolic acid in the proportion of a tablespoonful to two gallons of water as a deterrent, kerosene emulsion, pyrethrum powder, poison trap system for the cut worm, cold water for the common Celery Plusia, and the cleaning up of leaves and refuse material for the leaf-rollers. The use of Paris green against the leaf-feeders is not recommended since the poison after spraying settles around the edible portion at the base. After two sprayings with Paris green at the rate of 1 pound to 175 gallons of water certain plants were washed without separating the stalks and prepared as for market. They were then analyzed by Dr. R. C. Kedzie, who found that each pound of celery contained 0.0368 grains of arsenic. Celery sprayed once only contained 0.0244 grains of arsenic to the pound. This is far below a poisonous dose, but on account of the cumulative effects of arsenic Mr. Davis recommends that it be not used. The bulletin contains a number of original illustrations, most of which are poorly done. The text, however, will be of much use to celery growers.

The Spraying of Orchards.—Bulletin No. 60 of the Cornell University Agricultural Experiment Station summarizes the experience of the Horticultural Division at the Station in regard to the spraying of orchards. The bulletin is prepared by Mr. E. G. Lodeman, who treats his subject under the three heads: (1) The Profits of spraying Apple Orchards; (2) Tests of some Fungicides and Insecticides Upon Peach Foliage; (3) Some novel Insecticides and Fungicides. The profits of spraying are once more conclusively shown. The testimony of a number of practical orchardists is given in addition to the very pronounced beneficial results of the Station work. Peach foliage is once more shown to be extremely susceptible to the action of the arsenites. The novel substances tried were Iron chloride, Zinc chloride, Lead acetate, Fostite, Boron compounds, Iodine, Nitrate of soda, Caustic potash,

Abretic acid, Kreolin, and Antinonnin. None of them proved efficacious either as fungicides or insecticides, with the exception of Antinonnin. Concerning this substance Mr. Lodeman finds that it must be kept moist, else it becomes dangerous to handle. When used alone the action upon foliage is extremely caustic and the substance must be applied highly diluted. Lime reduces its caustic action, but it possesses no practical value in destroying insects by contact. On the whole, the Bordeaux mixture remains the best fungicide and Paris green and London purple the best general insecticides.

The Entomological Society of Ontario.—We have just received the Twenty-fourth Annual Report of the Entomological Society of Ontario, covering the year 1893. It is, as usual, full of interesting matter and contains a number of important articles. As a frontispiece is given an excellent portrait of Rev. C. J. S. Bethune, for so many years connected with the Society and with the development of economic entomology in Canada. The annual address of the President, Mr. W. Hague Harrington, treats of several insects of economic importance, including the Larch Saw-fly, Rose Saw-flies, Canker Worm, and a number of less important species, concluding with a review of the entomological publications of the year. Other contributors to the Report are Mr. James Fletcher, who presents an account of the injurious insects of the year; Rev. T. W. Fyles, who writes a most interesting article upon the entomological mistakes of authors, from Spenser to Fenimore Cooper. Mr. Fyles also contributes an article on the season of 1893, giving a record of his captures. Mr. J. Alston Moffat gives a most interesting article on the subject of mosquitos; Mr. Harrington a note on Canadian Uroceridae, and some additional notes on Japanese insects; Rev. W. J. Holland some notes and queries; Mr. T. J. MacLaughlin a popular article on the Dragon Fly; Mr. William T. Davis, the song of Thyreonotus, and Mr. Fletcher again, notes on some of the more important entomological exhibits at the Chicago Exposition. The volume concludes with an extended account of the Fifth Annual Meeting of the Association of Economic Entomologists, printing a number of the papers in full.

THE INSECTS OCCURRING IN THE FOREIGN EXHIBITS OF THE WORLD'S COLUMBIAN EXPOSITION.

By C. V. Riley.

Beginning with the first week of October and continuing at intervals up to date of writing, a number of newspaper articles and notices have appeared bearing upon the subject of the insect-infested grain exhibits at the World's Fair. From these accounts, nearly all of which are more or less erroneous, imperfect, and misleading, all sorts of opinions have become prevalent as to the ultimate danger of the introduction of new and undesirable insect pests. Indeed, some newspapers have seemed to take delight in magnifying the danger and in reflecting upon Chicago and the Exposition, and have even used a report, made by me to Mr. W. I. Buchanan, chief executive of the Department of Agriculture of the Exposition, and presently reproduced, as a basis for these exaggerated and somewhat sensational articles. Under the circumstances a full and truthful statement of the facts will serve a useful purpose.

In the first newspaper accounts which appeared the damage was with great uniformity attributed to "the weevil," which with equal uniformity was stated to be a new species introduced into the Agricultural Building in some of the foreign exhibits. For the benefit of the general reader it should be stated that while there are but two true grain weevils known to be established in this country, viz, the Rice Weevil (*Calandra oryzæ*) and the Grain Weevil (*C. granaria*), a score or two of other insects which attack grain after the manner of Calandra, are of common occurrence with us, and several of them are popularly but erroneously known as grain weevils.

On July 15 last I wrote to Mr. F. H. Chittenden, one of the assistants of this Division, then in charge of the entomological exhibit of the Department in the Government Building of the Exposition, to keep a lookout for new insects in the cereal exhibits of foreign countries and to report thereon. Acting under these instructions, Mr. Chittenden employed such opportunities as offered, and paid several visits through the summer to the foreign exhibits on the grounds of the exposition. Of the earlier species found, represented chiefly by dead specimens taken from jars of herbs, roots, seeds, and the like, a few were indeed new, but the living insects all proved to be of common and well-known species. Later, however, toward the close of September, many species not hitherto observed began to make their appearance in such

numbers in the Agricultural Building as to cause very general alarm among the exhibitors of agricultural products. Correspondence was had with the Division, and specimens sent by one of the State commissioners all proved to be well-known species already existing in this country.

Early in October a meeting of the State executive committee was called at which the subject of the distribution of insect-infested grain was seriously considered. The immediate cause of this discussion was due to the discovery of a large number of the common Rice Weevil (*Calandra oryzæ*) in the show cases of some of the State exhibits in the immediate neighborhood of the section devoted to the South American countries. The extreme abundance of the weevils in the exhibition cases referred to, which were so tight as to be nearly weevil-proof and covered with glass, makes it highly improbable that they were introduced in any foreign exhibits, but indicates that they were brought in an immature state in the grain from the States in whose exhibits they were found. The fact that the exhibitors or persons in charge of these exhibits protested with one accord that "the weevil" was unknown in their respective States counts for naught, since it is a well-established fact that this particular species is of common occurrence in every State and Territory in the Union.

At the meeting of the State commissioners referred to, a special committee was appointed to further investigate the matter and take such steps as should be found necessary. An expert report was also demanded, but, so far as could be learned, nothing whatever was done, nor was any attention paid to the circular letter which was sent out a day or two after this meeting by Mr. Buchanan. Of this letter, which was addressed to the commissioners of the various States and foreign countries having exhibits in the Agricultural Building, the following is a transcript:

To the Commissioner for ———,

Agricultural Building:

DEAR SIR: In order that there may be no possible danger of the introduction into this and other countries of the insect that has been found in the grains of several countries and States in the Agricultural Building, you are urgently requested to promptly carry out the following:

(1) Take immediate steps to have destroyed in the garbage crematory all grain in which the insect is found. Janitors will be instructed to take the grain you designate to the crematory if you so desire.

(2) Stop at once giving away or receiving samples of wheat, corn, oats, and other grains in which the insect works. Printed notices will be placed in the building cautioning visitors against taking away any samples of such grains.

(3) Seal all jars that contain wheat or other grain that attracts the insects.

(4) Make daily examinations of your exhibit and in every instance where the insect is found follow instructions in paragraph No. 1.

It is highly important that this be given your immediate attention.

Very respectfully, yours,

W. I. BUCHANAN,
Chief Department of Agriculture.

A keen interest was awakened in the subject, as made manifest by the articles in the columns of the daily papers of Chicago and by the correspondence with this Department. It finally assumed such dimensions that, at the telegraphic request of Mr. Buchanan, I was authorized by the Secretary of Agriculture to proceed to Chicago in order to make a personal survey of the matter and such recommendations as might be deemed advisable. A week of active work at the fair grounds, with the assistance of Mr. Chittenden, who had been, as already indicated, engaged for some time previously in investigating the matter, enabled me to draw up a preliminary report, which was addressed to Mr. Buchanan, embracing the essential features in the case, a list of the principal species found, and recommendations for the treatment of the infested material. This report, omitting the list of species, which is amplified in another place in this article, is reproduced herewith:

In view of its importance and of the interest which has been recently manifested in the subject of the insects that are injuring the various exhibits of agricultural products, and especially of grains, at the exposition, I have concluded to give you a brief statement of the actual facts.

No one recognizes more fully than I do the possibilities of harm from the introduction and distribution of undesirable insect pests, from which the United States has hitherto been free, or of the converse possibility of the injury we might do to other countries by sending them from this country undesirable species which they do not possess. The fact that Secretary Morton and Assistant Secretary Willits, of the U. S. Department of Agriculture, are equally alive to the importance of the matter is manifest by my presence here.

The following review of the condition of things is based on a personal survey of the field by myself and by careful examinations made during the last few weeks by Mr. F. H. Chittenden, one of my assistants, who has been specially charged with this work.

Some forty-odd species have been discovered and more or less carefully examined and studied. These may be divided into two categories, viz:

(1) Those which are already common in the United States and are for the most part cosmopolitan species; and

(2) Those which are either unknown or limited in their distribution in the United States.

By far the larger number of the insects affecting the exhibits of food products belong to the first category, and, in fact, almost everyone of the two dozen species contained in the exhibit of the Division of Entomology of the Department of Agriculture, as affecting stored grain, and enumerated on pp. 46 and 47 of the catalogue of said exhibit (Bulletin No. 31 of this Division), are to be found on the Exposition grounds. A number of the species found have no popular name, and their enumeration will convey little information to the general reader; yet I will give the list as a text for my conclusions and recommendations. [Omitted because amplified further on.]

The insects in the above list which have caused the greatest amount of damage are the two which are most commonly found in stored grain and other cereal products, viz, Nos. 1 and 14. These are the two that were sent on to me at Washington by one of the State commissioners, and have been referred to in the newspapers as "the Weevil."

No. 1, or the Rice Weevil, is believed to be a native of India, where it has been known to be an enemy to stored grain for over a century, and, perhaps, from time immemorial. The annual loss occasioned by it alone to wheat exported from India

was estimated five years ago to have amounted to £150,000 sterling. The species is perhaps the most widely distributed of known insects, being found in all quarters of the globe where grain is used, but is more injurious in tropical climes than in our own country, where, though it ranges from Alaska to Florida, it does its greatest damage in the Southern States. A correspondent estimates that there is an annual loss of $1,000,000 from this insect in Texas alone.

This insect appears in nearly all the cereal exhibits of tropical countries, as of Guatemala, Costa Rica, Mexico, Trinidad, Curacao, British Guiana, Brazil, Paraguay, Uruguay, Ecuador, and Argentine Republic, of this continent; and in Cape of Good Hope, Liberia, Orange Free State, Tunis, Siam, New Caledonia, Ceylon, and Java of the Eastern Hemisphere, and Australia.

It is particularly abundant in and about the vicinity of the Wisconsin and Minnesota sections in the Agricultural Building of the Exposition, and there is no doubt but that it was brought to the World's Fair from most of the countries mentioned, having existed in the egg or larva state before the grain was shipped.

The Rice Weevil infests grain of all kinds, seeming to thrive best in wheat, but attacking also maize, rice, Kaffir corn, and beans.

The mature Rice Weevil is a small, elongated beetle, about one-eighth of an inch long, dark brown in color, with four reddish spots at the corner of the wing cases. The female lays her eggs in the kernels of the grain, and the young are small, whitish grubs or larvæ, which, after transforming to the pupa state, issue as perfect beetles again. The species breeds rapidly and one generation follows another in from three to eight weeks, according to temperature. The egg-laying period of a single female continues through several weeks, and as there are from six to eight broods annually, the remarkable rapidity with which grain is ruined is not to be wondered at. This species is particularly bad in the Southern States and is gradually replacing the other species of its genus similarly known to infest grains.

No. 2, or the Angoumois Grain Moth, likewise abounds in southern grain fields and granaries, but is less injurious as we go northward. It is supposed to be of South European origin, but has been known in this country since 1728. It derives its popular name from the great destruction which it caused in the province of Angoumois, France, a little more than a century ago. It is a moth of a very light, grayish color, with four wings, more or less spotted with black. It measures about half an inch across with wings expanded and about a quarter of an inch in length with the wings closed. The eggs are delicate, pale red in color, with prismatic reflections, and they are laid in sheltered positions, as in the longitudinal grooves and the membranes which the different grains afford. The young are small, white, active worms, with a dark head, moving about actively by means of legs and spinning a silken thread.

This species, which is also cosmopolitan, is found in almost all the exhibits and is, in fact, flying all over the grounds.

Of all the insects belonging to the second category, [List also ommitted] a large number were found dead, and either died in the herbs, drugs, or other products in which they were found, since the Exposition opened or before they were shipped from the countries from which the exhibits were sent.

A certain number of the species, all those except the four last named, belong to those species which have already obtained a limited foothold in North America, or from which there is little to fear; while the small balance (Nos. 31, 32, 33, and 34) are of species, either heretofore unrecorded in North America or not sufficiently studied to intelligently report upon, as some of the species can not be accurately determined without comparisons, which it is impossible to make in Chicago from lack of accessible collections. It is to this last limited list that I would draw your special attention.

RECOMMENDATIONS.

The insects in the first category, two of which, as I have shown, have been the cause of whatever excitement there has been on the subject, may be dismissed without further attention, as far as North America is concerned. These and other more or less cosmopolitan species will multiply wherever they have an opportunity, but can cause us no harm by dissemination, as they are already with us. It may be different with some of our foreign exhibitors, and it behooves the representatives of foreign countries to be careful and not take back with them our own grains, or other products that are infested, unless they are sure that the species already occur with them. Whenever exhibits are infested as they almost invariably are in artistic designs made of grains which are more or less exposed, it behooves the exhibitors who wish to preserve such designs for future exhibit, to disinfect them.

In reference to the insects of the second category, Nos. 23, 24, 25, 26, 27, 28, and 29 may also be dismissed without further consideration, especially from an agricultural point of view. No. 30 is also not of vital importance, but I would strongly urge that all the exhibits containing them be absolutely destroyed, or if distribution is contemplated, first thoroughly disinfected. The few remaining species, 31, 32, 33, and 34, are interesting and important, and I strongly urge that effective measures be taken to either destroy the exhibits containing them or to thoroughly disinfect the same.

MEANS OF DESTROYING UNDESIRABLE SPECIES.

I have already, in official correspondence from Washington, in reply to specific questions, given recommendations for destroying the insects now working in the exhibits or of disinfecting said exhibits: First by the destruction of all living insects by submitting the exhibits to a temperature of over 200° F. either by dry heat or steam heat; secondly, by the use of the fumes of bisulphide of carbon.

In either case, some large, air-tight receptacle must be provided into which the exhibit may be placed. A large galvanized iron tank, with properly grooved lid or other openings, and with shelving to accommodate the various small exhibits, would be useful for this purpose, and I would strongly recommend that such a disinfecting receptacle be built, which should be sufficiently strong to stand the amount of heat which I have suggested, and sufficiently tight to permit the use of the bisulphide of carbon where the heat can not be applied. The precautions necessary in using and the methods of using bisulphide of carbon are generally well understood, and it is only needful to state that it must be carefully used, as the fumes are very explosive. Being heavier than air, these fumes will sink to the bottom of any receptacle; hence it is best to place the vessel containing it in the upper portion of such receptacle. About 1½ pounds are sufficient for a ton of grain.

In the above report, I have said nothing of the insects affecting the woolens, furs, and skins, etc., on exhibit, as to enter into this subject would make this report much longer than I intend, and also because there is not, relatively, as much danger of foreign introductions, since from observation, and inferentially, they are likely to be species already with us and cosmopolitan. Should occasion require, I will report on these later.

Concluding, it may be safely stated that a careful and intelligent review of the state of things removes unnecessary apprehension and is, on the whole, gratifying, as the species which might prove undesirable and injurious introductions are extremely few and easily managed, if the precautions which I have suggested be carefully taken.

I do not believe that dependence should be placed on any general orders such as that issued on the 3d instant, as experience shows that such general orders are rarely carried out. There must be somebody appointed whose duty it will be to see that the special work be done in the cases indicated, and that it be done thoroughly. If

left to the individual exhibitors to do at their own discretion, as in a general order, the danger is that the work will not be done at all. For this reason I strongly urge that some competent person be appointed to carry out whatever orders you may issue.

Some thirty-five species were enumerated in all, in the different series, but since the report was made the remainder of the material collected then and afterwards has been more fully identified by comparison with specimens in the National Collection and published descriptions, and the list is now as complete as it is possible to make it with the means for identification at our command. A number of the species, it has been found, can not be identified with the material at our disposition, and types of these, some of which are probably undescribed, have been sent to Dr. David Sharp, of Cambridge, England, for further study. A list of the species, together with notes on their occurrence, food-habits, and distribution, is appended, the cosmopolitan beetles being arranged to conform to the nomenclature adopted by M. Fauvel in his recently published list of the Coleoptera common to Europe and North America.

LIST OF INSECTS WHICH OCCURRED IN GRAIN AND OTHER STORED VEGETABLE PRODUCTS AT THE WORLD'S FAIR.

COLEOPTERA.

Clavicornia.

(1) *Homalota* sp.—A minute Staphylinid beetle, living in yam and other edible tubers from Mexico. This species is not injurious.

(2) *Silvanus surinamensis* L.—Occurred in some abundance in the exhibits of Argentine Republic, Brazil, Paraguay, Mexico, Trinidad, Liberia, Algeria, Tunis, Java, Greece, and Italy. Injurious to grain and dried fruits. Cosmopolitan and widely distributed in North America.

(3) *Silvanus bidentatus* Fab.—In chick-peas from Spain. Common to both continents, in grain and under bark.

(4) *Silvanus quadricollis* Lec. (=*gemellatus* Duv. [Fauvel]).—In the Brazilian exhibit, in sugar (accidental). Not uncommon in grain, cotton bolls, etc., in the South.

(5) *Silvanus cassiæ* Reiche (?).—Breeding in edible tubers in Mexican exhibit. Recorded from Arizona (Fauvel).

(6) *Silvanus advena* Waltl.—In exhibits of Brazil, British Guiana, Porto Rico, Venezuela, Mexico, Algeria, Liberia, etc., in grain, beans, edible tubers, dried fruits, etc. Cosmopolitan, common, and widely known in this country.

(7) *Nausibius clavicornis* Kug. (*dentatus* Marsh).—Found in preserved bananas in the Jamaican exhibit in the Manufactures Building. Cosmopolitan.

(8) *Pediacus depressus* Hbst.—In chick-peas from Spain. Common to Europe and North America.

(9) *Læmophlœus pusillus* Sch.—In grain and meal from Brazil, Uruguay, Paraguay, and Liberia. Cosmopolitan; occurring in the United States, but not known if it is injurious.

(10) *Læmophlœus ferrugineus* Steph.—Found in betel nuts from Johore. Said to be cosmopolitan, but its naturalization in this country doubtful. Apt to be confounded with the preceding species.

(11) *Cryptophagus acutangulus* Gyll. (?).—In Mexican exhibit. Common to Europe and North America. Not known to be injurious.

(12) *Cryptophagid* (?).—An unknown species, dark, shining brown in color and about five-sixteenths of an inch in length, living in corn meal, edible tubers, etc., in Mexican and Guatemalan exhibits. Would certainly prove dangerous if it could become naturalized here.

(13) *Litargus* sp.—A Mycetophagid beetle, not easily separable from *balteatus* Lec., breeding in numbers in various edible tubers, including potatoes, in exhibits of Mexico and Guatemala. None of this genus appears to be recorded as injurious.

(14) *Typhœa fumata* L.—Noticed only in Siamese exhibit. Common in this country and said to feed on stored grain, but not known to be injurious.

(15) *Carpophilus hemipterus* L.—A Nitidulid breeding in abundance in dried fruits in Tunis Building; also in Algerian and Guatemalan exhibits. Cosmopolitan.

(16) *Carpophilus dimidiatus* Fab.—Breeding in corn meal from Brazil. Widely known in the United States, but not known to be particularly injurious.

(17) *Ips 4-guttatus* Ol. (*fasciatus* Ol.).—Living in dates in Tunis Building. Abundant in the United States, but not known to injure dried fruits.

(18) *Lathridius minutus* L.—In Mexican and Spanish exhibits. Common in the United States.

(19) *Coninomus* sp.—Also from Mexico.

(20) *Corticaria ferruginea* Gyll.—From Spain and Mexico.

(21) *Corticaria serrata* Payk.—Also from Spain. Common to Europe and North America.

(22) *Corticaria* sp.—From Algeria.

Of the five minute Lathridiidæ above mentioned none are known as noxious.

(23) *Tenebrioides mauritanicus* L.—Occurred in corn, wheat, flour, and meal exhibited by several South and Central American countries. All the known species of this genus are predaceous, and its noxiousness largely consists in its presence, which, as it is a large species, is unwelcome in edible products.

(24) *Ostoma* (*Lophocateres*) *pusillum* Klug.—In cereal exhibits of Siam, Liberia, and Ceylon. Not included in our faunal lists, but believed by M. Fauvel to occur in North America. Uncertain whether predaceous or injurious.

Ptinidæ.

(25) *Dinoderus* sp.—Living in grain and edible tubers from Mexico and Guatemala. Liable to prove dangerous if it can become acclimated.

(26) *Dinoderus pusillus* Fab.—From Mexico; in exhibits of Mexico and Italy. Known to injure stored grain and other products in North America, and said to be cosmopolitan, but somewhat limited in distribution.

(27) Drug-store Beetle (*Sitodrepa panicea* L.).—In a variety of exhibits, including grain, and from various countries. Cosmopolitan and a well-known pest in drug-stores everywhere.

(28) Cigarette Beetle (*Lasioderma serricorne* Fab.).—No special search was made for this species, as it is widely known, occurring wherever tobacco is grown or stored. It was found, however, in all tobacco exhibits examined. It has received frequent mention in the past in this periodical.

(29) *Catorama tabaci* Guer. (?)—In commercial annatto from Brazil.

(30) *Hemiptychus gravis* Lec. (?)—Occurred with the above, which it closely resembles.

(31) *Lyctus* sp.—One of the "powder-post" beetles; in herbs in Paraguay exhibit.

Cerambycidæ.

(32) *Leptostylus* (?) sp.—A Cerambycid or long-horned beetle; in pods of Enterolobium from Paraguay.

Bruchidæ.

(33) Pea Weevil (*Bruchus pisorum* L. [*pisi* L.]).—Noticed only in exhibits of Turkey, Brazil, and Utah. Said to occur wherever the pea is cultivated.

(34) European Bean Weevil (*Bruchus rufimanus* Boh.)—the *Bruchus granarius* L. of many writers—occurred in most exhibits of large "broad" or Windsor beans, including those of Spain, Italy, Algeria, and Tunis. Although this species has frequently been brought here it has probably not obtained permanent footing in the United States.

(35) Common Bean Weevil (*Bruchus obtectus* Say).—The most formidable enemy of cultivated beans in North America. Beans damaged by this species were seen in the exhibits of Brazil, Venezuela, Mexico, Spain, Indo-China, etc.

(36) Lentil Weevil (*Bruchus lentis* Boh).—In lentils from Spain and Turkey. Has been reported from New York, but not known to have become introduced here.

(37) *Bruchus 4-maculatus* Fab.—Swarmed in beans from Brazil and Venezuela. Common in our more Southern States.

(38) *Bruchus chinensis* L. (*scutellaris* Fab.).—Breeding in profusion in bean exhibits of Japan and Porto Rico. Known in this country, but not yet widely distributed.

(39) *Bruchus chinensis* variety.—A small form of the preceding; in cultivated legumes from Ceylon.

(40) *Bruchus* sp.—A small species somewhat like the preceding; in cultivated beans from Brazil. Probably new and injurious, but no living specimens noticed.

(41) *Bruchus* sp.—A broad, reddish-brown species resembling in markings *B. obtectus*, in "pigeon peas" from Trinidad. This species is also liable to be injurious, but was not found living.

(42) *Bruchus* sp.—In wild legume from Costa Rica.

(43) *Bruchus* sp.—From seeds of Annatto from Paraguay and Venezuela

(44) *Bruchus* sp.—In seed pods of Divi-divi from Curaçao.

(45) *Bruchus* sp.—In wild legume from Argentine Republic.

(46) *Bruchus* sp.—Bred from Enterolobium pods from Paraguay.

(47) *Bruchus* sp.—Bred from wild legume from Brazil.

(48) *Caryoborus* sp.—In vegetable ivory from Ecuador..

None of the seven species last mentioned are likely to be of economic importance in this country.

(49) *Spermophagus* (*Zabrotes*) sp.—A form resembling our native species; breeding in the greatest abundance in cultivated beans in the exhibits of Guatemala, Brazil, and Mexico. Likely to be introduced, and without doubt a dangerous species.

Tenebrionidæ.

(50) *Tenebrio* sp.—A living larva of this genus, probably either *T. molitor* L. or *T. obscurus* Fab., our common "meal worms," was found in corn in the Guatemala Building.

(51) *Tribolium ferrugineum* Fab.—Occurred in the cereal exhibits of most of the countries of tropical and subtropical America, Asia, and Africa, ranking in abundance with the Rice Weevil and Angoumois Grain Moth. Common also in Europe, and well distributed over this country, where it is sometimes called "flour-weevil," and is often injurious to grain, meal, flour, and a great variety of other products.

(52) *Tribolium confusum* Duval.—Occurred in Annatto from Liberia. The same form occurs in the United States, where it has been generally confused with the preceding, from which it differs chiefly in the form of the antennæ.

(53) *Palorus melinus* Hbst. (*depressus* Fab.)—In meal from Brazil. Although not recorded in Henshaw's List, a series of this species in the National Museum shows that it is probably entitled to a place in the list of introduced species.

(54) *Gnathocerus cornutus* Thunb.—Occurred in the Brazilian exhibit in flour. It is said to be cosmopolitan but is recorded only from the Pacific coast of North America.

(55) *Echocerus maxillosus* Fab.—Occurred in meal in the Brazilian exhibit, and is doubtless firmly established in this country, although still limited in distribution.

(56) *Alphitobius piceus* Ol.—In a jar of sorghum (?) seeds from Indo-China.

(57) *Alphitobius ovatus* Hbst. (*diaperinus* Muls.).—In an unknown product in the Siamese exhibit.

The last two species are cosmopolitan, and recorded in our local lists. Probably scavengers, at least not known to be injurious in America.

(58) *Phylethus* (*Alphitophagus*) *bifasciatus* Say.—Living in abundance in dried fruit in one of the Central American buildings. Common in the United States, but not known to injure dried fruits. Observed by Mr. E. A. Schwarz, of this Division.

Rhynchophora.

(59) Rice Weevil (*Calandra oryzæ* L.).—This species, as stated in the report to Mr. Buchanan, was found in the cereal exhibits of nearly all the tropical countries of both hemispheres. It thrives on all kinds of stored grain, including maize, wheat rice, rye, Kaffir corn, barley, oats, etc.

(60) European Grain Weevil (*Calandra granaria* L.).—Occurred in the cereal exhibits of Spain, Mexico, Algeria, Cape of Good Hope, etc., being found in the greatest abundance in chick-peas. Although common enough in the United States it is still limited in distribution.

(61) *Calandra remotepunctata* Gyll.—Considered merely a variety of the above.

(62) *Calandra* sp.—A weevil similar to the two preceding, from leguminous seeds or beans from Brazil.

(63) *Balaninus* sp.—Larva in acorns from Algeria.

(64) *Cryphalus jalappæ* Letz.—A small Scolytid in German exhibit in Manufactures Building. Infests jalap of commerce, but not considered detrimental.

(65) *Coccotrypes dactyliperda* Fab.—Occurring in fruit of three species of palms exhibited by an Italian firm.

(66) *Coccotrypes* sp.—In leguminous pods from Paraguay.

(67) *Hypothenemus eruditus* Westw.—A single dead specimen of this cosmopolitan species which is discussed somewhat at length in Mr. F. H. Blandford's article in this number, was picked up in the Agricultural Building.

(68) *Aræocerus fasciculatus* DeG.—Breeding in mace from Trinidad and Johore, and in cocoa beans from Liberia. Common in Southern States, but not especially injurious.

The following, each represented by a dead specimen, were undoubtedly of accidental occurrence:

(69) *Platynus* sp.—In a jar of chick-peas from Spain.

(70) *Conosoma littoreum* L.—With the above.

(71) *Otiorhynchid.*—In a jar of Brazilian beans.

LEPIDOPTERA.

(72) Indian Meal Moth (*Plodia interpunctella* Hbn.).—This well-known speeies occurred in abundance in several buildings in the exhibits of Argentine Republic, Brazil, Guatemala, Mexico, Cape of Good Hope, Orange Free State, etc., in grain, dried fruits, nuts, seeds, etc.

(73) Mediterranean Flour Moth (*Ephestia kuehniella* Zell.).—Living in meal, bran, and cakes in Mexican exhibit. Already introduced, but not widely known as a pest.

(74) *Ephestia* sp.—Breeding in most exhibits, of which there were many, of cocoa beans. Infested beans are not considered by manufacturers in any way inferior to those which are free from attack. This moth has certainly been imported, many times a year, probably, for the past century, and as it is not positively known to have become naturalized here there is little to fear from it in future.

(75) *Ephestia* sp.—A similar moth to *E. kuehniella*, but somewhat larger and

darker. Bred from seed pods of St. John's bread in the exhibit of the Spanish colonies.

(76) *Ephestia* (?) sp.—A dull gray moth, with an expanse of about five-eighths inch, bred from a gall in the Japanese section of the forestry building.

(77) *Tinea* sp.—A moth with an expanse of about half an inch, white, with the fore wings spotted with black after the manner of *T. granella*, was found infesting seeds of date palm in the Italian exhibit.

(78) *Tinea* sp.—A moth resembling the preceding, infesting Bombay nutmeg or soap nut exhibited by an American firm in the Agricultural Building.

(79) Angoumois Grain Moth (*Gelechia cerealella* Ol.).—This species, as already stated in my report to Mr. Buchanan, was very generally distributed about the grain exhibits in various buildings, and was, in fact, flying about all over the grounds. A rather full account of this species will be found in my Annual Report for 1884 and another in the preceding volume of INSECT LIFE (vol. V, pp. 325–328).

Four moths in such condition as to render identification doubtful were found as follows:

(80) From Acacia pods in Costa Rica Building.

(81) From leguminous pods from Paraguay.

(82) In case containing products from New Caledonia.

(83) Injuring yeast cakes in exhibit of Johore.

Among other products damaged by moths the following may be mentioned:

Beans from Paraguay; currants from Greece; velvet-seeds from Jamaica;* locust beans from Algeria, and various nuts and seeds in other exhibits.

It might be added here, as an interesting entomological fact, that the Army Worm (*Leucania unipuncta*) was found in some cereal from Mexico, living specimens hatching out in one of the cases in their section.

OTHER ORDERS.

(84) Anthomyiid.

(85) Anthomyiid (?).

(86) Stratiomyid.

The above three species of Diptera occurred in tubers and herbs in the Mexican exhibit. The first was identified by the adult, the other two by the puparia.

(87) The American Cockroach (*Periplaneta americana*) was noticed in the Brazilian exhibit.

(88) *Lyctocoris* sp.—A Heteropteron, resembling the bedbug, breeding in tubers in the Mexican exhibit.

(89) *Pemphigus* sp.—Bred from a gall-nut in the Japanese exhibit of the Forestry Building.

(90) *Atropos* sp.—In nuts in Algerian exhibit.

(91) *Atropos* sp.—In various exhibits of different kinds, particularly those of Brazil and Mexico.

(92) *Gamasus* sp.—A minute mite in Mexican corn exhibit.

(93) *Gamasus* sp.—With the preceding.

None of the last seven mentioned are of any great economic importance, save the cockroach, which is already widely distributed.

Of hymenopterous parasites the following were found:

(94) *Pteromalus calandræ* How.—Parasite of Rice Weevil (*Calandra oryzæ*). In Mexican exhibit.

(95) *Catolaccus* sp.—On sack of corn in Mexican exhibit.

(96) *Diglochis* sp.—Parasite of *Lyctus* sp. from Paraguay.

---

*The author of this injury is probably the Ephestia, mentioned in this number under the title "Some Jamaican insects," among the general notes.

(97) *Meraporus* (?) sp.—Fairly swarming in French section of Agricultural Building in grain in sheaf, badly infested with *Gelechia cerealella*.

(98) *Meraporus* sp.—Parasite of *Bruchus 4-maculatus* from Brazil.

(99) *Meraporus* sp.—One other species, which has been referred to this genus by Mr. Ashmead, was found at large in the agricultural building.

(100) *Ateleopterus tarsalis* Ashm.—Parasite of *Silvanus surinamensis*. Taken with its host in the exhibit of Argentine Republic.

(101) *Prosacantha* sp.—In Spanish exhibit.

All of the above are minute four-winged flies, the first six belonging to the family Chalcididæ, the last two to the Proctotrypidæ. They are all more or less beneficial according to their abundance, serving in a measure to check the excessive multiplication of their injurious hosts.

ECONOMIC IMPORTANCE OF SPECIES FOUND IN VEGETABLE PRODUCTS.

In the Coleoptera, the Clavicorn series, represented by Nos. 1 to 24, is composed largely of scavengers and predaceous species. Of the injurious forms not already introduced only No. 5 (*Silvanus cassiæ?*), 12 (the Cryptophagid?), and 13 (*Litargus* sp.) are of importance, while the exact economic status of 24 (*Ostoma pusillum*) is doubtful.

The species of the family Ptinidæ, which includes Nos. 25 to 31, are, with one or two exceptions, more or less injurious. No. 26 (*Dinoderus* sp.) is the only unintroduced species to be feared, although the further distribution of 25 (*Dinoderus pusillus*) would be undesirable.

Of the family Bruchidæ or bean weevils (Nos. 33 to 49), the first seven are known to be injurious to beans, peas, or lentils, and 40 and 41 are probably so. A portion of these that are not known to live in this country were found only as dead specimens, and hence may not be able to live continuously in dried legumes. Those most to be feared are 37 (*Bruchus 4-maculatus*) and 38 (*B. chinensis*), both already introduced, but as yet limited to the more Southern States. No. 48 (*Spermophagus* sp.) is not known to occur here, and its introduction is not desirable. These three occurred in abundance at the Fair, and in their habits in living in dried beans resemble the common Bean Weevil.

Of the Tenebrionidæ, the first six are meal-worms and injurious. Of these four species, viz, *Palorus depressus*, *Gnathocerus cornutus*, *Echocerus maxillosus*, and *Tribolium confusum*, have not yet been very extensively distributed through the United States, and their further dissemination is to be avoided.

The Rhynchophora or true weevils (Nos. 59 to 68) contain nothing new of importance.

In other orders only the three grain moths—the Indian-meal Moth, the Angoumois Grain-moth, and the Mediterranean Flour-moth—are worthy of much consideration. The first two are cosmopolitan and the third is nearly so.

To sum up, there is every probability that all of the species enumerated in the foregoing list as having been found in grain and other

edible products had previously been brought to this country. A considerable proportion of the injurious cosmopolitan species are still confined in the United States to the Atlantic and Pacific coast cities and to the neighborhood of large commercial centers.

ON THE DANGER OF NEW INTRODUCTIONS.

The interchange of seeds, it was learned by inquiry, was confined almost entirely to the countries whose exhibits were free from any dangerous species. This interchange and the promiscuous distribution of seeds practically ceased with the appearance of the circular sent out from Mr. Buchanan's office requesting the abandonment of the same. Thousands of samples were taken away from open bags and other receptacles, but the insects infesting such exposed samples were for the most part confined to the commonest species, and the chances of introduction from these handfuls are extremely small. The same is true of the sheaves of cereals used in the decorations, which were taken away in armfuls by visitors at the close of the Fair. Finally, the very thorough work of disinfection, as presently set forth, diminished the chances of undesired introductions to a minimum.

The four species already mentioned as those from which the greatest danger was to be apprehended, viz, the unknown species of Cryptophagidæ, Litargus, Dinoderus, and Spermophagus, are tropical species, and could hardly become acclimated at the North. One or more of them might have become established in the extreme Southern States if they had escaped, but I do not hesitate to say, considering all the facts, that the probabilities of such a contingency are slight, and that no species which affect stored grain or other vegetable products have been distributed or have found a foothold in regions where they could multiply and become injurious. On the whole, therefore, it may be confidently stated that a thorough review of the facts gives assurance that no dangerous introductions were made, for, even if some of the species indicated as not previously found within our borders should become established, they are of such a nature as not to compare with the more cosmopolitan and injurious species which already affect our grain and which we already have to contend with.

TREATMENT OF INFESTED CEREAL EXHIBITS.

I was quite anxious that nothing should be left undone to effectually disinfect or destroy those exhibits which contained species that were new to North America and which were undesirable introductions, and, although unable to remain until the close of the Exposition or carry on this work personally, I was glad to be able to make an arrangement with Mr. Buchanan whereby Mr. Chittenden was especially engaged

to superintend this work of disinfection and destruction in accordance with the recommendations which I had made. The report which Mr. Chittenden has submitted justifies the conclusions just set forth and is as follows:

A large iron tank, with a capacity of about 1½ tons, was procured and provided with a shelf and a large tightly fitting door. A small building, known as the "Stock Exchange," situated near the Agricultural Building, was next secured and fitted up as a workroom. In this the tank and other materials used in the disinfection of the grain were stored. A large quantity of material was removed to this building and disinfected as rapidly as time would permit.

It was seriously contemplated by those in authority to destroy all the grain in the Agricultural Building, whether foreign or domestic, infested or free from insects; in fact, Chief Buchanan was quoted in one of the Chicago daily papers as having expressed this intention. To prevent such a contingency and to decisively settle the matter to the satisfaction of all, it was considered best to remove all the infested material from the foreign exhibits of this and other buildings. As soon as all necessary arrangements were perfected and the requisite permissions from commissioners, custom-house officers, and others were obtained for the removal of infested exhibits, the work was begun and rapidly pushed to its completion.

It was impossible to use bisulphide of carbon, benzine, naphtha, or other insecticides of this nature in the buildings, the insurance policies held by the Exposition prohibiting the use of inflammable substances, and it was therefore necessary to remove material to be disinfected from the buildings.

Experience having shown that Indian corn and, after that, wheat are preferred above all other food by grain insects, it was deemed a wise move to destroy not only all infested corn and wheat, but also such few samples as showed no outward signs of infestation, but that might contain the pests, either in the larval or egg state, concealed in the kernels.

The bulk of the corn exhibited by all except the colder countries was more or less badly infested, and the wheat as well. The entire corn and wheat exhibits of many of the tropical countries, the good with the bad, were therefore confiscated wherever it was possible to obtain possession of them.

As an example of the work done, a few words in regard to the disposition of some of the cereal exhibits might be interesting.

The first exhibit visited was that of Mexico, in the Agricultural Building, previous inspection having shown that it contained more dangerous species than any other. The grain exhibit of this country, which was one of the largest on the grounds, was displayed in half a dozen large show cases distributed throughout the section, and a large quantity of samples that had not been unpacked, owing to lack of space, were stored in boxes in a small anteroom. Through the courtesy of the commissioner in charge, Mr. Romulo Escobar, the entire exhibit was abandoned for such disposal as should be deemed fit. First, all of the exposed samples were removed, whether infested or not, and after that the boxes of samples in the storeroom were unpacked and nearly all, including the boxes themselves, taken to the crematory and burned. Of the remaining samples, such as were stored in bags and not injured past redemption were placed in the disinfecting tank and treated with bisulphide of carbon. In all, several tons of material, including upwards of a thousand samples of grain, flour, meal, beans, etc., were removed from this exhibit, requiring the services of six men with three carts.

In the Guatemala Building many of the same injurious species were found, conspicuous among which were the Ptinid (*Dinoderus* sp.), the little bean weevil (*Spermophagus* sp.), and the Mycetophagid (*Litargus* sp.). A large quantity of infested material was removed from the exhibited samples, and in an attic storeroom so large a number of damaged samples, consisting chiefly of grain, beans, and other edible products, were found that a truck was necessary for their removal.

The other exhibits visited in which injurious insects were found, and from which more or less infested material was removed, were as follows: Those of Algeria, Brazil, Cape of Good Hope, Ceylon, Japan, Liberia, Orange Free State, Paraguay, Siam, Spain and the Spanish Colonies, and Uruguay, in the Agricultural Building; Costa Rica, the French Colonies of New Caledonia and Indo-China, Tunis, Turkey, and Venezuela, in the government buildings of their respective countries.

The foregoing list includes all the exhibits which contained insects of economic importance. The cereal exhibits of other countries were also visited, but inspection showed that they were either free from infestation or contained only a few of the more common insect pests, rendering no action necessary.

The exhibits in which no insects of a dangerous character were found were as follows: Those of Java, Curaçao, Italy, British Guiana, Johore, Trinidad, Ecuador, Canada and the other British provinces of North America, Russia, and the other North European countries in the Agricultural Building; those of Greece and Jamaica in the Horticultural and Manufactures Buildings, respectively; and the exhibits of Colombia, Haiti, India, and Ceylon in their respective government buildings.

INSECTS AFFECTING ANIMAL PRODUCTS.

It was not deemed necessary to make an extensive study of the insects affecting woolens, furs, hides, and other animal products on exhibit, as there is comparatively little danger of introductions from abroad. A few species, however, were observed and collected by Mr. Chittenden, all (with possibly one exception) cosmopolitan and widely diffused throughout this and other countries. The following is the list:

Larder Beetle (*Dermestes lardarius* L.).—About Exposition grounds.

Leather Beetle (*Dermestes vulpinus* F.).—Living on dried fish and hides, in Mexican exhibit.

Red-necked Ham Beetle (*Necrobia ruficollis* Fab.).—With the above on dried fish.

Red-legged Ham Beetle (*Necrobia rufipes* De G.).—With the two preceding, on fish and on cheese.

Cheese Skipper (*Piophilus casei* L.).—Accompanying the preceding, on cheese. It also attacks hams and has received special mention in an article in the last number of INSECT LIFE (pp. 170–175) and in the Extracts from Correspondence in the present number.

Trogoderma tarsale Melsh.—Breeding by thousands in silkworm cocoons in U. S. Government Building. A well-known museum pest, probably identical with a European species.

INSECTS NOTICED IN THE FORESTRY BUILDING.

Time did not permit of very extensive collecting in the Forestry Building. From time to time, however, as opportunity offered, Mr. Chittenden visited this building, and a few species, all Coleoptera, were taken, a list of which is furnished herewith. All but two species were picked up from the windows where they were resting, and it is therefore impossible to state the locality from which they were brought. This is particularly true of the first four species, which, with the exception of the Læmophlœus, are all cosmopolitan and might have been brought into the building with foreign exhibits, in packing material or otherwise, or have flown in at the open doors or windows. Several other species besides those mentioned in the list were observed in this

building, but they were all domestic and not known to affect woody plants.

Silvanus advena Waltl., previously treated as No. 6 in the list of grain insects, was noticed in the Forestry Building.

Lœmophlœus sp.—An undetermined species not known to inhabit North America, and from its habitus evidently subcortical.

Lathridius minutus L.—Previously mentioned under No. 18.

Coninomus carinatus Gyll.—Probably introduced. Commonly found in old flour barrels. This species might more appropriately have been placed with the grain insects, but its occurrence was noted only in the Forestry Building.

Corticaria fenestralis L. (*deleta* Mann.).—A common and well distributed species.

Melanophila longipes Say.—Well known and widely diffused in the North, where it infests pines and other conifers.

Agrilus sp.—An exotic Buprestid resembling *scitulus* Horn, and possibly from Mexico or Central America. It probably infests deciduous trees.

Cerambycid.—A number of examples of a large Cerambycid or long-horned beetle of a genus unknown in North America, bred out from a stump of *Charisia insignis*, a Malvaceous tree from Argentine Republic. The stump was without bark and the wood was completely ruined by past generations of this species. In their exit the beetles had bored through several large photographs that were attached to the stump.

Platypus compositus Say (?).—A native species of Scolytidæ restricted to the Coniferæ.

Xyleborus affinis Eichh. was bred from a part of the trunk of a leguminous tree, *Erithrina cristigalli*, in the section of the Argentine Republic.

Tomicus cacographus Lec.—A common native species, also a Scolytid, depredating on pine and other conifers.

Phlœotribus frontalis Ol.—Very abundant in the Forestry Building. It is a common species affecting Mulberry and Hackberry.

Hylesinus aculeatus Say.—A well-known American species, attacking ash.

THE HYMENOPTEROUS PARASITES OF THE CALIFORNIA RED SCALE.

By L. O. Howard.

In none of the numerous habitats of the now wide-spread *Aspidiotus aurantii* have true hymenopterous parasites been found except in California. Mr. D. W. Coquillett, in the course of several years' careful study of the insect at Los Angeles in his capacity as field agent of the Division of Entomology, has reared several parasites which he has sent on to Washington from time to time for study. All have been designated to him by their generic names, but none have heretofore been thoroughly studied for descriptive purposes. Sufficient material has now been reared by Mr. Coquillett to warrant the technical characterization of the species, and this paper has therefore been prepared at Prof. Riley's suggestion.

There are, in Mr. Coquillett's material, six distinct species which are undoubted parasites of the Red Scale. Mr. Coquillett also sent in, in

1887, a specimen of a handsome species of the Mymarid genus Alaptus which he had reared from orange leaves infested with the so-called Yellow Scale from San Gabriel. This he at first supposed to be a parasite of the scale insect, but as he afterwards reared a large series of the same species from the little eggs of a Psocid—*Cæcilius aurantiacus*—he concluded that his first specimen probably issued from some unnoticed Psocid egg among the scales on the leaves. He is, without much doubt, correct in his conclusion, and the species is mentioned here simply to warn other investigators against falling into the same error.

The true parasites are as follows:

(1) *Aspidiotiphagus citrinus* Craw
(2) *Coccophagus aurantii* n. sp.
(3) *Coccophagus lunulatus* n. sp.
(4) *Aphelinus diaspidis* Howard.
(5) *Signiphora californica* n. sp.
(6) *Aphycus immaculatus* n. sp.

Owing to the occurrence throughout this article of the names "Red Scale," "Yellow Scale," "*Aspidiotus aurantii*, typical form," and "*Aspidiotus aurantii* var. *citrinus*," it will be necessary to explain that they all refer to the same species, which exists in California in two different forms. The typical *Aspidiotus aurantii*, or Red Scale, is the form described by Maskell from New Zealand, and which also occurs in Australia and in the Mediterranean countries. It was studied by Prof. Comstock in California, in 1880, and described and figured in his report for that year. The name "Yellow Scale" is in common use in California, and refers to a light brownish-yellow variety of the Red Scale which occurs principally in the San Gabriel Valley in California, but which is also found in all other orange-growing portions of the State. This variety differs not only in color, but the dorsal and ventral scales seem to be more firmly cemented together than with the typical Red Scale, and it occurs, moreover, only upon the leaves and fruit, never upon the bark, while the typical Red Scale occurs very abundantly upon the bark as well as upon the leaves and fruit. The typical Red Scale, moreover, seems to be oviparous, while the Yellow Scale is viviparous. The Yellow Scale is mentioned in some California publications as *Aspidiotus citrinus* Coquillett, and Mr. Craw is of the opinion that it is a distinct species and was imported independently from Japan into the San Gabriel Valley. The name *Aspidiotus citrinus* Coquillett was sent to Prof. Riley with a MS. description, but from his own careful study in California and correspondence with Mr. Coquillett, Prof. Riley concluded that the structural differences between the two forms are not constant, and that *citrinus* can only be considered as a variety.

(1) ASPIDIOTIPHAGUS CITRINUS (Craw).

Coccophagus citrinus Craw. Destructive Insects, etc., Sacramento, 1891.
Encarsia citrinus (Craw). R. & H., INSECT LIFE, Vol. IV, p. 168, 1891.

In 1887 Mr. Coquillett sent to Dr. Riley two specimens of a parasite reared from the so-called yellow variety of the Red Scale received from San Gabriel, Cal. In Dr. Riley's absence I wrote him that the insect was a new species of Coccophagus and gave him the manuscript name *C. aurantii*. This insect, or another one, subsequently made some stir in horticultural circles in California, since it was the first known parasite of the Red Scale, and Mr. Alexander Craw, the entomologist of the State Board of Horticulture, was commissioned to examine the orchards in which the parasite occurred and report. He did so, and we understand advised the discontinuance of spraying on account of the abundance of this species. A great deal of newspaper discussion as to the advisability of this course followed, and the State board, in its report for 1891, published a number of letters tending to show the abundance and importance of the parasite.

FIG. 6.—*Aspidiotiphagus citrinus* (Craw) greatly enlarged (original).

In 1891 Mr. Craw drew up a report upon the species, under the title "Internal Parasites; discovered in the San Gabriel Valley; Recommendations and Notes," which was published as Bulletin No. 57 of the State Board of Horticulture. In this bulletin he gave a technical description of *Coccophagus citrinus* Craw, accompanied by a figure and a preliminary statement concerning the discovery and work of the insect.

Later in the same year a bulletin was published and distributed by the State Board of Horticulture bearing the title "Destructive Insects, their natural enemies, remedies, and recommendations. By Alexander Craw," etc. On pp. 28 and 29 of the bulletin are given a figure and description of "*Coccophagus citrinus* Craw," both of which differ, in some respects, from the figure and description in Bulletin No. 57.

We suspect that these two descriptions refer to two distinct insects, since two species bearing a strong general resemblance to each other

have been sent us by Mr. Coquillett as reared from the so-called "Yellow Scale," the one having perfectly clear wings, as shown in Mr. Craw's earlier figure, and the other having the fore-wings with a fuscous band, as shown in his later figure. I shall not push this point, however. Mr. Craw may have described two distinct insects under one name. If so, we shall accept his second and presumably more careful figure and description as carrying the name. Mr. Craw's reference of the form to the genus Coccophagus was probably based upon our original determination as sent to Mr. Coquillett, but unfortunately for this reference the form sent us was the clear-winged one, and that which bears Mr. Craw's name has other generic affinities. Mr. Coquillett sent us specimens of the dusky-winged form bred January 18 and 24, and February 2, 1889, from San Gabriel scales and from these specimens, as well as from Mr. Craw's figure, we tentatively placed the species in Fœrster's genus *Encarsia* (INSECT LIFE, Vol. IV, p. 168). More prolonged and critical study, however, renders it evident that a new genus must be erected to contain the species.

Aspidiotiphagus gen. nov.

Female.—Antennæ 8-jointed; scape long, slender; pedicel a little longer than its apical width; funicle joints 1, 2, and 3 increasing in width, but each approximating pedicel in length; club long, distinctly 3-jointed, basal joint shortest, apical joints sub-equal, terminal joint pointed. Lateral ocelli equi-distant from each other and margin of compound eyes. Parapsides of mesoscutum widely separated, very narrow posteriorly, broadening out rapidly towards tegulæ; mesoscutellum like that of Aphelinus, its scapulæ longitudinally elongate and extending forward to lateral widening of the parapsides; metanotum very narrow. Abdomen short, broadly sessile and broadly rounded at tip. Spur of middle tibiæ very slender, as long as the short, first tarsal joint. Fore wings long, narrow; submarginal and marginal veins sub-equal in length; post-marginal lacking; stigmal very slight and parallel with costa, situated at half the wing length and exactly opposite to the termination of thickening of hinder margin of wing; this being also the widest point of the wing; cilia of wing surface rather sparse, a clear rounded space immediately below stigma, and a narrow clear line around margin; marginal vein bristly; marginal cilia very long, longer than wing width, those on costal margin just beyond stigma nearly as long as those on hind margin. Hind wings very narrow, with long marginal cilia and but one row of discal cilia on outer third; marginal vein ending abruptly and extending up apparently beyond costa.

Differs from Coccophagus in wings and from Encarsia in antennæ and wings.

ASPIDIOTIPHAGUS CITRINUS (Craw).

Female.—Length 0·58 mm; expanse 1·16 mm; greatest width of fore wing 0·09 mm. Antennæ light yellow-brown; eyes black, ocelli bright-red; head yellow; occiput dark brown; pronotum dark brown; mesonotum yellow; metanotum yellow-brown; abdomen brown; legs uniformly dusky yellow; wings with marginal vein dark fuscous, and a broad fuscous band extending directly across wing from marginal vein as a base. Spiracular hairs on pre-anal abdominal joint very long. Thorax somewhat wider than head or abdomen, these being sub-equal in width.

Redescribed from 14 ♀ specimens reared January 18 and 24, February 2, and March 13, 1889, by D. W. Coquillett from *Aspidiotus aurantii* Maskell, var. *citrinus*, from San Gabriel, Cal.

There are four specimens of this species in the collection of the Department of Agriculture, reared January 6, 1881, from *Diaspis bromeliæ* Kern. on *Ananassa sativa* in the greenhouses of the Department.

(2) COCCOPHAGUS AURANTII n. sp.

This is the original clear-winged form referred to in the preliminary remarks under the last species. We have but two specimens, and these were reared by Mr. Coquillett, May 9, 1887. It is the species to which

FIG. 7.—*Coccophagus aurantii* n. sp.; greatly enlarged (orginal).

we gave the above name in MS at the time of its first receipt. It differs from the typical Coccophagus principally in the long fringe to the hind wings; but it hardly seems necessary to erect a new genus for it.

COCCOPHAGUS AURANTII n. sp.

Female.—Length 0·7 mm.; expanse 1·16 mm.; greatest width of forewing 0·18 mm. Joint 1 of funicle shorter and narrower than pedicel and than joint 2, which is subequal to pedicel in length and width; joint 3 shorter than 2. General color light brownish yellow; occipital line, margin of pronotum, scapulæ, outer edge of me tanotum, abdomen, especially lateral margin, darker; antennæ and legs light fuscous; eyes black, ocelli red; wings hyaline, veins slightly dusky. Fore-wings with disc densely, finely, and uniformly ciliate, costal margin with very short marginal cilia beginning at stigma, growing gradually longer at tip of wing and on lower outer margin becoming half the width of wing; broadest portion of wing beyond stigma; hind wings with two rows of discal cilia and an incomplete third row on outer third; cilia of lower margin somewhat longer than greatest wing width.

Described from two female specimens reared May 9, 1887, by D. W. Coquillett from *Aspidiotus aurantii* var. *citrinus* from San Gabriel, Cal.

Specimens of this species occur in the collection of the Department of Agriculture, reared from the following species of Coccidæ: *Aspidiotus ancylus* Put. var. on Linden, District of Columbia; *Mytilaspis citricola* Pack. on Orange, Florida; and *Aspidiotus pini* Comst. on *Pinus rigida*, Ithaca, N. Y.

This form may be at once distinguished from the preceding by the fact that its fore-wings are twice as broad in comparison to their length, are perfectly clear, and have no very long cilia on their anterior margin. It is a somewhat larger species and lighter in color.

(3) COCCOPHAGUS LUNULATUS n. sp.

In November, 1892, Mr. Coquillett sent to the Division some orange leaves thickly covered with the Red Scale for use in the collections which were then being prepared for the Chicago Exposition. These leaves were carefully mounted, but as it would be some little time before they would be needed for the boxes, they were placed in a glass jar to ascertain whether they were parasitised. A week later a single para-

FIG. 8.—*Coccophagus lunulatus* n. sp.; greatly enlarged (original).

site issued which proved to be a typical Coccophagus (not an aberrant one like the preceding species), but belonging to an undescribed species. It is a very handsome form and is readily distinguished by its coloration no less than by its structural features from any of the other Red Scale parasites.

COCCOPHAGUS LUNULATUS n. sp.

Female.—Length, 0·93 mm.; expanse, 2 mm.; greatest width of fore-wings, 0·39 mm. Head rather coarsely punctulate, opaque; mesonotum very finely shagreened, somewhat glistening; mesoscutellum with apical bristles very long; abdomen smooth, shining. General color black; apical three-fifths of mesocutellum bright orange, with an irregular black spot at tip and with the dividing line between the orange and black irregular; tegulæ black; antennæ with the scape black and the flagellum dark fuscous; front legs, including coxæ, light orange yellow, considerably lighter than the mesoscutellum; middle and hind coxæ and hind femora black, middle and hind trochanters, tibiæ and tarsi and middle femora light orange yellow. Wings hyaline, veins dark brown, marginal cilia very short.

Described from one female reared December 5, 1892, from *Aspidiotus aurantii* received from D. W. Coquillett, Los Angeles, Cal.

(4) APHELINUS DIASPIDIS How.

APHELINUS DIASPIDIS How. Annual Report U. S. Department of Agriculture, 1880, p. 355.

This species was first reared from *Diaspis rosæ*, received in 1880 from Fort Reed, Fla. Later, specimens were received, reared from the same species of scale, from Santa Barbara, Cal. Specimens were received from Mr. Coquillett in 1892, which were found upon leaves infested with *Aspidiotus aurantii* received from Santa Ana, Cal., in July and August. Some specimens were observed by Mr. Coquillett in the act of ovipositing in the scales.

FIG. 9.—*Aphelinus diaspidis* How.; greatly enlarged (original).

This species is larger than either of those previously described, and is bright yellow in color. It is probably the "golden Chalcid," referred to by Mr. Craw in his article in the *California Fruit Grower* of February 28, 1891.

(5) SIGNIPHORA OCCIDENTALIS n. sp.

In his work on Orange Insects published at Jacksonville, Fla., in 1880, Mr. W. H. Ashmead erected the genus Signiphora to contain a species which he called *S. flavopalliata* and of which he had reared two specimens from *Aspidiotus citricola* Pack., the Purple Scale of the Orange. Since Mr. Ashmead's volume is now very rare, we reprint his generic characterization:

SIGNIPHORA Ashmead.

Form, robust, polished, or shining; head wider than thorax, ocelli 3, triangularly arranged; labial palpi 3-jointed; antennæ inserted in front between the eyes, rather close together, 3-jointed; first joint or scape long; second small and round; third large and fusiform; thorax broad, not quite as long as abdomen; legs setaceous, with five-jointed tarsi, first joint longest; hind tibia in place of the usual spine furnished with an anomalous five-lobed appendage, in this respect differing

from any known Chalcid. Abdomen somewhat sharply pointed and ending in a rather long ovipositor. Wings well rounded and strongly ciliated. Coxæ almost touching.

In the Annual Report of the U. S. Department of Agriculture for 1880 (p. 371), we called attention to this remarkable insect and stated that Mr. Ashmead was probably in error in locating the "anomalous five-lobed appendage" upon the hind legs instead of upon the middle legs, since it is probably homologous with the apical spur of the middle tibia so strongly developed in the Aphelininæ and Encyrtinæ.

Subsequent rearings of specimens from *Mytilaspis gloverii* and *Aspidiotus cydoniæ* from Florida, from an Aleyrodes on oak from California, by Mr. Coquillett, and from *Aspidiotus aurantii* by the same gentleman, as well as the deposit of one of Mr. Ashmead's types in the collection of the U. S. National Museum, have enabled us to make a careful

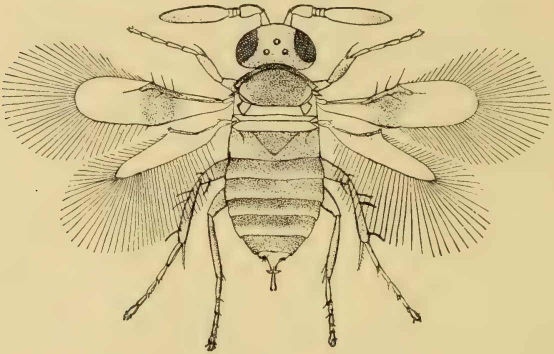


FIG. 10.—*Signiphora occidentalis* n. sp. greatly enlarged (original).

study of this peculiar genus. It differs so markedly from all other known Chalcididæ that it must be placed in a subfamily by itself, and we therefore propose for it the subfamily name *Signiphorinæ*. Several important points in the structure of the insect were not made out by Mr. Ashmead, and with more abundant material at our disposal we have drawn up a somewhat closer description of the genus and have characterized the subfamily, adding a description of the new species reared by Mr. Coquillett from the Red Scale.

SIGNIPHORINÆ, Subfam. nov.

Tarsi 5-jointed. Apical spur of middle tibia long and with *several long spines on inner edge.* Pronotum reaching nearly to tegulæ. Mesoscutum entire. *Mesoscutellum represented by a narrow transverse band.* Mesopleura short, sharply divided from metapleura. *Metascutum with a differentiated triangular central sclerite,* resembling the normal mesoscutellum. Antennæ at most 8 jointed. Ovipositor cleft of female abdomen extending back to 3d segment.

SIGNIPHORA Ashmead.

Type, S. flavopalliata Ashm. Orange Insects, 1880, p. 30.

Body robust; ocelli 3, situated in triangle. Antennæ inserted at border of clypeus. 6-jointed; scape reaching nearly to top of head; pedicel large, nearly as long as scape; funicle joints 1, 2, and 3 very small; club very long, undivided. Face round; mandibles strong, bidentate; labial palpi rudimentary; maxillary palpi 3-jointed. Fore-wings rather broad and short; submarginal and marginal veins subequal in length; marginal thick; stigmal thinner and curved; marginal and stigmal veins with several long, stiff bristles; no discal cilia; marginal cilia very long and delicate, beginning on costal margin just beyond stigmal and extending around to a point opposite the stigmal. Hind-wings narrow and with very long and delicate cilia beginning beyond marginal vein and extending around nearly to hinder base of wing. Middle tibiæ with a number of stout bristles, apical spur as long as first tarsal joint and furnished on inner edge with five or six long bristles at regular intervals; front and hind legs unarmed. Abdomen broadly sessile, rounded at tip; ovipositor of female somewhat extruded, apical spiracles facing ventrally; male penis long, cleft at tip.

SIGNIPHORA OCCIDENTALIS n. sp.

Female.—Length, 0·53 mm.; expanse, 1·2 mm.; greatest width of fore-wing, 0·09 mm. Antennal scape robust, reaching to middle of eyes; pedicel large, stout, rather more than one-third as long as scape; funicle joints 1, 2, and 3 subequal in diameter, very small, together only a little over one-third length of pedicel and considerably less than the tip width of pedicel; increasing in length from 1 to 3; club nearly as long as scape and pedicel together, long oval when seen from side, twice as wide as pedicel, narrow with parallel sides when seen from above, scarcely wider than funicle joint 3. Marginal vein with 6 strong bristles, stigmal with one, submarginal with one. Middle femora with a strong spine near inner side of tip, tibiæ with three strong external spines, two near base and one near tip. Color (from balsam-mounted specimens only): Head, pronotum, metanotum and abdomen, dark brown, nearly black, eyes dark red; mesonotum bright lemon-yellow; all legs and antennæ fuscous; mouth parts light-brown, mandibles tipped with black; wing veins fuscous; fore-wings with an indefinite fuscous patch occupying entire disc except at base and apical fourth.

Male.—Resembles female, except that it is rather larger and has the entire mesoscutum brown, leaving the yellow band to include mesoscutellum and metascutum.

Described from two ♀, three ♂ specimens reared by D. W. Coquillett, from *Aspidiotus aurantii* var. *citrinus*, from San Gabriel, Cal., May 30, June 1 and 3, 1887.

(6) APHYCUS IMMACULATUS n. sp.

The sixth of the Red Scale parasites belongs to another subfamily, the Encyrtinæ. Mr. Coquillett reared two specimens of this form from typical specimens of *Aspidiotus aurantii* October 11, 1887, and unfortunately mounted both specimens in balsam. The species has not been reared since, and hence can not be properly studied from dry mounts. Enough of its characters, however, are brought out in the balsam mounts to separate it from all described species. It is possible that this is the adult of an interesting parasitic larva which Mr. Coquillett

has studied, and of which he writes that, as it increases in size, it causes the dorsal scale to separate from the ventral so that the adult escapes from beneath the scale instead of gnawing a hole through it.

APHYCUS IMMACULATUS n. sp.

Male.—Length, 0·55 mm.; expanse, 1·3 mm.; greatest width of fore-wing, 0·21 mm. Antennal scape slightly widened below, pedicel nearly half as long as scape, club as long as three preceding funicle joints together, funicle joints with hairs rather longer than length of each joint; mesoscutum with punctation longitudinal down

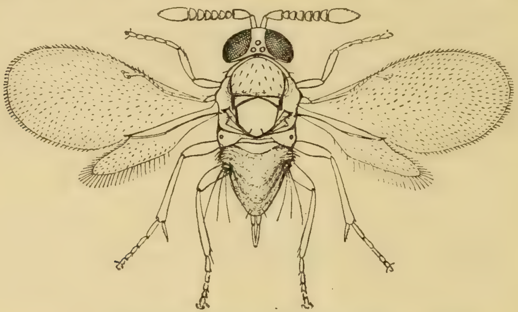


FIG. 11.—*Aphycus immaculatus* n. sp., greatly enlarged (original).

middle, transverse each side; metascutum with short longitudinal punctation; scapulæ and visible portions of metascutum with lengthy transverse punctation. Hairs from third abdominal spiracles extending beyond tip of abdomen. Color uniform dark yellow brown, head light yellow, all legs dusky; antennæ uniformly dusky yellow; wings hyaline.

Described from one balsam-mounted ♂ reared from typical *Aspidiotus aurantii*, by D. W. Coquillett, at Los Angeles, Cal., October 11, 1887.

THE INSECT COLLECTIONS OF THE COLUMBIAN EXPOSITION.*

By F. H. CHITTENDEN.

Several accounts have appeared of the collections of insects exhibited at the World's Columbian Exposition, but, as only one of these has apparently made any attempt at completeness, it has been thought desirable to present to the readers of INSECT LIFE, as a matter of record, a more complete list of these exhibits.

The exhibit of the Division of Entomology of this Department was displayed in the U. S. Government Building, and as a complete catalogue of it, including all except a series of eight large cases of forest tree insects, which was originally prepared to form part of the Forestry

*A report made to the Entomologist of the exhibits other than that of the U. S. Department of Agriculture.

exhibit, has been issued as Bulletin No. 31 of this Division, no further comment is necessary. Copies of this bulletin were kept for distribution on the desk of the writer, who was in charge of the exhibit from the completion of its installation till near the close of the Fair, and whose duty it was to explain special features of the entomological exhibit and answer questions relative to insect injury and the means to be employed for the prevention and destruction of injurious species.

Another collection exhibited in the Government Building was that of the United States National Museum. It consisted of thirty-two large cases designed to illustrate the classification of the families of American insects, using the word in its widest sense. This collection was prepared under the direction of Prof. Riley by Prof. J. B. Smith, and was purely educational in character. The different family characters were given on printed labels, and illustrated by full series of specimens and drawings, many of the latter original and unpublished. This, as well as the major portion of the exhibit of the Department of Agriculture, will be preserved in the National Museum.

The Division of Ornithology and Mammalogy of the Department of Agriculture also exhibited a few insects in this building, including two cases of insects commonly eaten by the Crow, Crow Blackbird, Cedar-bird and King-bird.

In the Illinois State Building, the Illinois State Laboratory of Natural History, and the University of Illinois made a very creditable display, about one hundred and twenty-five cases in all being exhibited. For this, two rooms and their outer walls were used. The first of these was fitted up as the office of the State Entomologist and his assistants, being supplied with desks and tables, books and book-cases, typewriter, printing-press, microscopes, and other office appliances. The smaller represented in miniature an insectary or rearing-room, and was furnished with vivaria and the customary apparatus used in rearing insects.

On the book-shelves there were about 1,400 volumes, constituting a third of the entire entomological library of the State laboratory.

Of the preserved specimens the following were exhibited:

A large series of the commoner insects of Illinois, arranged in systematic order, well mounted and labeled and made up of new specimens gathered in the field expressly for this purpose. This included nine cases illustrative of the distribution of Illinois butterflies.

A part of the students' reference collection of the University of Illinois.

Five cases of insects, constituting a series which is furnished by the State laboratory to the high schools of the State.

An exhibit of noxious insects, including a series of about two hundred species that injuriously affect the Apple, and similar smaller cases of insects injurious to Corn, Wheat, the Strawberry, and other crops.

The more important species were accompanied by excellent original colored illustrations of the adult insect, the work of Miss Hart.

One of the best features of the Illinois exhibit was a series of eleven cases representing by specimens the average food of a robin for a year. There were also smaller series of the insects forming the food of other birds, and of fishes.

This exhibit was in the constant charge of a representative from the State laboratory. It was originally intended to carry on here a part of the routine entomological work of the laboratory, of rearing and caring for insects, experimenting, and answering correspondence, but lack of funds prevented.

There was also on exhibition, in a different quarter of the building, a small series of cases designed for class work, from the Northern Normal School of Illinois.

In the Agricultural Building, in the Office of Experiment Stations, a prominent place was devoted to its entomological exhibits, which were composed of contributions from entomologists of different stations.

West Virginia contributed fifteen cases, chiefly of wood and bark damaged by bark and timber beetles of the family Scolytidæ. These specimens were selected with great care and showed the characteristic work of the different species. A catalogue of these insects, most of which were represented in the exhibit, was issued by the station, but was not available to the visitor.

New Jersey exhibited fourteen cases of the injurious insects which furnished the text of the special entomological bulletins of the station. This included insects injurious to the Cranberry, Squash, Grape, Blackberry, and Sweet Potato, a special case of the "Rose-Bug," and four cases designed to illustrate methods and apparatus. A feature of this exhibit was the specimens of plants showing the nature of the injury done by the insects. The insects were exhibited in large series, neatly and artistically arranged and fully labeled, the collection being on the whole the most appropriate of all in this exhibit.

Maine made a unique exhibit of five cases of biologic material, consisting of microscopic slides, vials, and pinned specimens, together with colored illustrations of the life-history of the Apple Maggot (*Trypeta pomonella* Walsh). A copy of the station bulletin on this subject was attached to one of the cases in a convenient manner for reference.

Of the other stations contributing material, Mississippi had one case of insects which have received special study at that station, another of North American Myriopoda, and a third of species injurious to cotton. Nebraska had three cases of insects affecting the Sugar Beet, the remainder of the contribution of this station being exhibited in the Forestry building. The Cornell station of New York contributed two cases, evidently designed to show the Comstock block system and biologic vials. Kansas was represented by six neatly arranged cases of insects affecting the Apple. South Dakota showed eight

cases of "tree-claim insects." Iowa exhibited twelve cases and Louisiana three of different orders, chiefly adults. The exhibit of the Colorado station consisted of eight cases of biologic material and showed evidence of original observations, but which while excellent in its way was somewhat out of place as showing the work of an experiment station. Oregon exhibited two cases labeled "some Oregon pests" and a third of "a few Oregon insects," the latter chiefly Coleoptera.

In addition to these there were four cases of silk-worm moths, both foreign and native, together with blown larvæ, but with no indication of the contributor or the source from which they were derived.

It is to be regretted that several of the last-mentioned contributions were inappropriate in this exhibit and were insufficiently labeled, there being nothing in some cases to indicate the station making the contribution except the minute locality labels attached to the pinned specimens. It is also a matter of regret that the contents of several cases were completely ruined in transportation.

A part of the Experiment Station exhibit consisted of a series of frames, labeled "original illustrations," contributed by different States, in the main original, but composed in part of illustrations from other sources than the station exhibiting them. There was also an exhibit of collecting and mounting apparatus, a series of models showing the internal anatomy of insects, and a small exhibit of insecticides and insecticide machinery, including eleven jars of kerosene emulsion prepared according to different formulæ, the latter contribution from Mr. H. E. Weed, of the Mississippi station.

A large exhibit, composed principally of named Coleoptera and Lepidoptera, but with a fair representation from other orders, was shown in the Minnesota section of the Agricultural Building. It consisted of forty-eight large cases including, besides the above, a series of the various species of grasshoppers collected by the use of a "hopper-dozer," nine cases of economic species in their different stages, and two cases of galls. The installation of this exhibit was most unfortunate, the entire upper half of three cases having been placed so high as to render it impossible for the average visitor to read the labeling.

In the Canadian section was exhibited a very good series of the Lepidoptera of the Dominion, each species being represented usually by but one or two specimens, and smaller series of Coleoptera and Hymenoptera.

In the Austrian section of this building, and in the gallery of the Manufactures and Liberal Arts Building, there were small series of jars of alcoholic material, very neatly arranged, with printed labels, and showing the transformations of one or more large and conspicuous species of the different orders of insects.

Smaller entomological exhibits were displayed in this building by Java; British Guiana, and Japan.

In the Forestry Building a few interesting collections were displayed. One of the best of these was that of the experiment station of West

Virginia, which differed but little in character from that exhibited in the Agricultural Building.

Russia was represented by a very creditable display from the Institute of Forestry at St. Petersburg, consisting of about forty cases of samples of trees destroyed by Scolytidæ. Twenty samples of the work of *Scolytus rugulosus*, a species common to both hemispheres, were shown, from which an idea could be obtained of the variation in the work of one of these insects in different kinds of wood.

In the German section a small exhibit of some of the principal forest insects and their work was displayed, together with photographs showing the effects of their ravages.

Nebraska furnished about forty cases including, besides insects injurious to forest and shade trees, a considerable number which affect various farm crops, and which should have been allotted space in the Agricultural building.

Michigan also exhibited a series of nineteen cases of the commoner forest-tree insects of that State, the species represented chiefly by pinned adults, with much unnecessary duplication.

The largest foreign entomological exhibit was that made by Japan in the Manufactures and Liberal Arts Building. This consisted of nearly two hundred cases of all orders well mounted and, barring slight injury to a few cases in transportation, in excellent condition. This collection, although arranged in approximately systematic order, was unnamed.

An interesting and unique exhibit in this building was that of the Chicago Varnish Company of insects imbedded in gum copal, mostly from the north coast of Africa and New Zealand. About thirty specimens of the gum were displayed, and the insects, although made up chiefly of Coleoptera, included ants, cockroaches, flies, termites, a spider, and both Homoptera and Heteroptera. The beetles were mostly Longicorns and Lamellicorns, but included also Scolytidæ, Carabidæ, Cleridæ, and Lucanidæ.

In the gallery of this building, in the educational section, several exhibits were displayed. The Agricultural College of Michigan contributed a lot of boxes made up from material gathered by students during their college course, and a group of photographs of graduates who had been engaged in teaching entomology or had held office as entomologists in experiment stations. The New South Wales exhibit was contributed by the Macleay Museum of Sydney University, and was composed of a dozen cases, equally divided between the Coleoptera and Lepidoptera, mostly well mounted, identified, and labeled. The Mexican exhibit was made up of different orders, the specimens mostly in poor condition and unlabeled. Japan and Germany also showed specimens of the work done in their schools, the latter country particularly excelling in the amount of biologic material.

In the Anthropological Building there were two exhibits of Lepidoptera, that of Colorado, contained in seventy-two cases, and one owned

by Mrs. J. G. Sorup, a Chicago collector. The latter collection was contained in over fifty cases, and included both native and exotic species. Brazil contributed to the exhibit of this building a small series, mostly of showy forms in poor condition.

In the German Government Building, unfortunately in an obscure corner of the basement, a creditable display of insects destructive to forest insects was made by the Waldhof Sulphite Company. Complete catalogues in German and English were furnished.

In the Colombian Building, in an ordinary commercial show case, there was displayed a lot of showy and brillant butterflies, with a few dragon-flies, beetles, and other forms, making a very pretty display. As with others of the exhibits of South and Central America, none of them were named, and no attempt had been made at classification in arrangement.

India in her Government Building displayed four cases of Lepidoptera from the Himalayas.

Costa Rica exhibited ten large colored plates of Lepidoptera, evidently the efforts of an amateur, and a similar number of cases of insects of different orders in very indifferent condition.

Kansas had a small lot of boxes of Lepidoptera in her State building.

In the Women's Building there was a small lot of boxes of Lepidoptera from Wisconsin, and some original drawings by Mrs. A. B. Comstock and others.

In addition to the galls shown in entomological exhibits, some good collections were displayed in the botanical sections. Of these Germany exhibited two in the educational section of the Manufactures Building and the third was located under the dome of the Horticultural Building.

Illustrations of insects, drawings, paintings, wood-cuts, lithographic plates, etc., formed a prominent part of many exhibits of art work of schools, colleges, and other institutions.

Quite a quantity of material was brought from some of the southern countries, but was so badly injured in transportation as to be utterly unfit for exhibition. Of such were a number of cases from Costa Rica and Colombia, Guatemala and Ecuador.

A few exhibits, small in extent and importance, were reported by different visitors at the Fair, but as they were not seen by the writer no account is given. These included a series of fossil insects, and insects found in amber shown in the Mining building, and a few boxes from New Mexico in the gallery of the Manufactures building.

Spraying machines and other apparatus for the destruction of injurious inseccs were displayed in various other exhibits besides those already mentioned. Prominent among them were the exhibits of Vermorel and several other companies in the Horticultural Building, those of the Deming Company in the same building and in Machinery Hall, and that of the Nixon Nozzle and Machine Company.

In the Austrian section of the Agricultural Building five different Dalmatian firms contributed samples of insect powder and chrysanthemum flowers used in its preparation.

Large silk exhibits were made by Japan and France in the Manufactures Building and by the U. S. Department of Agriculture in the Government Building. Smaller exhibits were made in the Agricultural Building by France, Mexico, Brazil, Greece, Algeria, and Russia, and still others were distributed about the grounds, notably in the Turkish and Columbian pavilions and in several State Buildings. The best of these exhibits showed the silk-worm in its different stages, the eggs on cards, blown larvæ in their successive moults, chrysalids, cocoons, and adults, and the silk, raw and manufactured.

There were large domestic and several foreign exhibits of bees, honey, and other apiarian products and appliances, which have received notice in a more extended report elsewhere in this number.

THE APIARIAN EXHIBIT AT THE COLUMBIAN EXPOSITION.*

By Frank Benton.

Seventeen States and Territories and twenty-three foreign countries and colonies made entries of apiarian products or implements used in apiculture. But ten States, namely, California, Iowa, Illinois, Indiana, Minnesota, Michigan, Nebraska, New York, Ohio, and Wisconsin, made displays worthy of special notice. Seven other States and Territories had small entries of honey or wax among their general exhibits of agricultural products, while the remainder of the Union, embracing some very excellent honey-producing areas, was wholly unrepresented. The exhibits were, however, creditable, and though no more than half what our country should have shown, they were infinitely superior to those of any other country, taken as a whole, represented at the Fair, not merely on account of their size, in which respect it would hardly be fair to compare with them the exhibits of foreign countries which by reason of their distance from Chicago were placed at a disadvantage, but the character and quality of the exhibits—a sure index of the plane to which apiculture had attained in a given country—was, in the case of the United States, such as to warrant quite a degree of patriotic pride on the part of American bee-keepers.

Looking at apiculture in the foreign departments of the Fair anyone familiar with the condition of the industry abroad, especially in the leading countries of Europe, could not fail to be struck by the fact that it was very inadequately represented, that in truth hardly a foreign country that made entries in this line had done itself justice, while many that might have made excellent exhibits were not represented at all. This

* Report of observations made during October under instructions from the Entomologist.

is in striking contrast to the character of the apicultural exhibit of the United States at the Paris Exposition of 1889, where the finest of all the exhibits was unquestionably that made by the United States, unprejudiced authorities, both French and German, conceding this.

GREAT BRITAIN AND COLONIES.

The collective exhibit in apiculture made under the British flag contained by far the finest and largest show of honey made by any foreign country. Although the United Kingdom herself had a creditable display of honey, it was chiefly due to one province alone in Canada—the province of Ontario—that the exhibit as a whole could fairly rank with those made by several of our States.

Great Britain and Ireland.—For the largest and best arranged display of honey from Europe this country deserves the first place. This exhibit was made by the British Bee Keepers' Association and the societies affiliated with it, about one hundred members sending 5 to 50 pounds each, showing different varieties and qualities. The aggregate of 1,000 to 1,200 pounds was all placed in small glass jars neatly labeled with the association label, the name of the producer, the locality, and the kind of honey being given. The British Bee Keepers' Association examines candidates for the title of expert bee-keeper and grants certificates of three grades to successful competitors. Specimen pages of the works used in these examinations and copies of the certificates were on exhibition.

Canada.—A magnificent display of both comb and extracted honey, nearly filling a case 25 feet long, 5 feet wide, and 8 feet high, was sent from the province of Ontario, there being forty-nine exhibitors. Many experts were undecided as to whether the palm should be given to this exhibit or to some of the State exhibits. The Ontario comb honey was particularly fine, the sections being well filled out to the wood, combs even, and wood and combs clean. The show of extracted honey was good, there being also many varieties. Comb foundation of good quality and reversible honey-extractors were exhibited by the Goold, Shapley & Muir Company, of Brantford.

Ceylon.—A bottle of honey gathered by the great bees of India, *Apis dorsata*, was of a beautiful golden color and most excellent flavor. The wax from the same source was also good.

New South Wales.—Some eighty jars of honey from this colony were on exhibition in the Agricultural Building. The style of package was not very attractive, but one-half of the jars contained honey that was clear, liquid, and of good color.

GREECE.

Four lots of honey, about 250 pounds, from this Kingdom were shown. Two were labeled Attica, one Mount Hymettus, and one Cerigo. All were in large jars, crystallized, and presented a brown appearance.

The flavor reminded one of wild thyme, but the taste of pollen was so strong as to render the honey unfit for table use. Modern methods in apiculture have not gained a foothold in Greece, and the custom is still to crush the combs and strain the product, which is then transported to market in goat skins.

ITALY.

As far as regards attractiveness the honey exhibit from Italy is entitled to first rank among those from Europe, and in quantity it was second only to Great Britain. Much credit is due to Signor Carlo Passerini, of Turin, who had 500 to 600 pounds of honey, 150 pounds of which was in glass jars neatly labeled, the whole presenting a very fine appearance. He also exhibited some fifty boxes of honey caramels, and liquors prepared with honey as one of the ingredients. G. Bonafede, of Palermo, Sicily, showed some 60 pounds of light-colored extracted honey in white glass jars, labeled as orange honey, but which had a strong biting flavor—conclusive evidence that the bees had not confined themselves to orange blossoms alone, the flavor of pure orange honey being very mild and delicious. An extractor of practical construction was also shown by Mr. Bonafede.

JAPAN.

A small but interesting exhibit was made by Japan. One of the simplest native hives, built in sections, placed one above another to the number of six, was shown. While not presenting any features that could be advantageously adopted here, it is of especial interest to American bee-keepers, because it is constructed on the principle of the shallow, horizontally-divided section hive, and, being one of the oldest Japanese hives, antedates by a few centuries the patent granted by our Government on this feature in bee-hives.

A jar of honey and a box of bleached wax were included in the exhibit. The former sells at about 5½ cents per pound in Japan, the latter at 18 cents.

American and European apiarists know little regarding the honey bees of Japan, and the case containing a queen, drones, and workers of one of the cultivated varieties was of especial interest. Though the specimens were damaged by moisture it was easy to see that the bee is a true *Apis*, but differing considerably in size and markings from all of the European and Western Asiatic races of honey bees. They resemble, as near as could be determined, the Carniolan race more than any other, but the workers and drones are smaller and the former show yellow bands, which true Carniolans do not possess.

MEXICO.

Quite an attractive case of honey and wax of various colors and qualities and a native hive—a section of the bark of a palm tree, comprised the exhibit from Mexico. Some of the honey reminded one in

its flavor of orange groves, while several were labeled Agave honey (*miel de maguey*). Altogether the exhibit would lead one to regard Mexico as a favorable region for this pursuit.

RUSSIA.

The Russian exhibit was more complete than any other foreign representation, including, as it did, besides honey and wax, also hives and models of hives, various implements used in the apiary, comb foundation, and products of wax or honey. Many of the models and implements were sent by the Agricultural Museum of St. Petersburg. The only full-sized frame hive in the collection, shown by the Russian Society of Apiculture, was essentially a two-story Langstroth hive, the size of the frame being about that of the Quinby hanging frame. Russia has of late copied much from French Switzerland in apicultural matters, and this country has adopted with eminent success many American methods. Langstroth's work, as revised by the Dadants, has recently been translated into Russian. The extracted honey shown by Russia was not of a very high grade, but some sections of comb-honey were very fine, both in quality and appearance. The sections were made of strips of glass.

OTHER COUNTRIES.

Among the foreign exhibits the following-named countries were represented by entries which may be briefly passed over: Argentine Republic, wax of various grades; Austria, wax candles; Brazil, dull gray wax and candles of dull yellow wax; Costa Rica had seven entries, noticeable among which was comb honey in American one-piece wooden sections, the only ones in any of the foreign exhibits except those of Canada; Ecuador, wax; France, represented by Algeria, with four jars of honey and two separate lots of beeswax; also honey from the penitentiary of Tledes Pins, New Caledonia, and honey from Annam-Tonkin; Germany, two entries of products; Guatemala, white, gray, and yellow wax, four jars of honey from cane (labeled "miel de cana"); Haiti, one dozen jars dark liquid honey; Siam, one entry only; Spain had but one jar of honey on exhibition, but that was of exquisite quality; the Spanish colony, Porto Rico, showed several specimens of wax of indifferent quality; Turkey, one dozen specimens of wax broken from larger cakes, not properly cleansed but otherwise good; Uruguay, yellow wax in bulk and very fine white wax candles; Venezuela, a half dozen jars of strained honey of poor quality and four cakes of wax ranging from fair white to black.

THE UNITED STATES.

The special State exhibits in apiculture were shown in large glass cases located on the balcony in the southeast part of the Agricultural Building. There were eighteen of these cases, several of which were 15 feet, and the rest, 25 feet long, 5 feet wide, and 10 feet high.

California was represented by one case containing comb and extracted honey, the exhibit, owing to difficulty in securing appropriations, being neither as large nor as good as might have been expected from such a honey-producing State, where some of the most skillful specialists are located.

Iowa had one case containing in the center a pyramid built up of pound sections filled with comb honey and two smaller pyramids of jars of extracted honey. The word "Iowa" in capital letters worked out in comb honey by bees appeared in front. E. Kretchmer had well-made hives and implements on exhibition.

Illinois.—This exhibit filled four large cases, one case containing 2,200 pounds of comb honey in sections built up to represent a castle; a second was filled with a competitive display of comb honey, on the front in letters of comb honey the motto: "In God we Trust," and the name "A. Coppin, Wenona, Ill.," whose bees worked the letters. The show of extracted honey filling one case was excellent, while the wax which occupied the fourth case was of fine quality and skillfully wrought. Most of it was contributed by Ch. Dadant & Son. The same firm exhibited their fine comb foundation. The Porter bee-escape was also shown.

Indiana had in a single case a creditable exhibit, including comb and extracted honey, wax, and a drink prepared from honey. A. G. Hill had quite a collection of apiarian implements, hives, etc.

Minnesota.—Although this State produces as fine honey as any in the Union and has able bee-keepers, the exhibit, like those of several other States, was not a fair index of this. It consisted of comb and extracted honey in one case.

Michigan.—A single case contained as fine extracted honey as was to be seen on the grounds, and some of the comb honey was slightly excelled, if at all. Wax and foundation of good quality were shown. Bingham smokers and knives were included in the exhibit.

Nebraska.—Comb and extracted honey, wax flowers and figures very skillfully wrought, and the largest collection of mounted honey plants shown occupied the Nebraska case, while back of it were several nuclei with Italian bees in them.

New York had a large and very fine exhibit of comb and extracted honey, quite a number of apiarian supplies, and several colonies of bees. The latter stored some 40 pounds of comb honey per hive while on the grounds. The supplies, excellent in quality, were sent by W. T. Falconer, J. VanDeusen & Sons, and M. E. Hastings.

Ohio.—The comb and extracted honey from this State was of fine appearance, also wax of very fine quality was shown. The largest display of implements, hives, etc., on the grounds was that made by A. I. Root.

Wisconsin.—The exhibit of comb and extracted honey from Wisconsin was not large nor particularly fine, but showed to the best advan-

tage in its tasteful arrangement. A six-comb self-reversing extractor of novel construction was shown by F. Williams. Springs throw the basket out when the speed of the machine is decreased, and turning in the opposite direction reverses them simultaneously.

In the foreign exhibits in apiculture there seemed to be nothing in the shape of new implements, hives, or methods of management indicated which American apiarists could adopt to advantage in their apiaries. But some of the educational features of the exhibit from Great Britain and Ireland were indeed worthy of the attention and, the writer believes, even of adoption, in the main, by apiarian societies here, particularly the examination and certification of experts of various grades, which the British Bee Keepers' Association practices. American bee-keepers, after a careful review of all that foreigners showed in apiculture at the Fair, could feel warranted in believing their methods in apiculture—the American system, which is distinctive—far in advance of all others. American manufacturers of apiarian supplies might also find suggestions as to additional markets for their products. And the magnificent piles of beautiful honey from the United States and Canada and the practical implements and hives shown with these exhibits must surely have served to give valuable information and increase the interest of many who are anxious to engage in the raising of bees, or, having begun, need to know in what way they can make further progress. To foreigners who were fortunate enough to see these exhibits, especially to the apiarists among them, it was a great revelation as to the actual advanced position of American apiculture.

THE SAN JOSÉ SCALE, AT CHARLOTTESVILLE, VA*.

By E. A. Schwarz.

SITUATION OF THE INFESTED ORCHARD.

The pear orchard of Dr. C. H. Hedges lies on a ridge just at the city limits of Charlottesville, about one-third mile from the center of the city and adjoining one of the main roads leading into the open country. While there are many gardens with various fruit trees between Dr. Hedges' place and the business part of the city, yet there is no other real orchard so close to the city excepting two old apple orchards situated at the base of the ridge and considerably distant from Dr. Hedges' place.

The infested orchard forms a square of about one acre in extent, and is, on the east side, separated from the street by an open grassy place about 25 steps across. On the north side it joins the lawn opposite and behind Dr. Hedges' house, where some old oak trees and vari-

* Report of investigations made under instructions from the Entomologist.

ous fruit trees are scattered about; on the west side it joins immediately the extensive vineyard of Dr. Hedges, which covers the slope of the ridge; finally, on the south side it is separated from the garden of Judge Reeves by two board fences and a narrow alley.

The orchard itself is planted with choice dwarf fruit trees, mostly pear, the trees being rather crowded, so that in many instances the branches interlock. On the northern side there is an open patch originally planted with currant bushes, but these having mostly died in the course of time are now replaced by strawberries. There are also a couple of small beds of various garden flowers, including a few rose bushes. Along the fence at the south side there are finally several rows of raspberry plants. The soil beneath and between the fruit trees is generally bare excepting numerous purslane plants growing on the less shaded places. Finally, there is a solitary fine Sweet gum tree (*Nyssa multiflora*) at the west side of the orchard.

THE INFESTED PLANTS.

The whole orchard, which was laid out eight years ago, may be said to be badly infested with *Aspidiotus perniciosus*, but by no means evenly so. To begin with the fruit trees, there were no scales whatever on the few quince trees and Japanese persimmon, though these stood in the immediate vicinity of other badly infested trees; there were a very few scattered scales on the young twigs of a few dwarf apples (Japanese) and plum trees (several varieties), a few more on peach trees. The pear trees form by far the greatest bulk of the orchard, and here a very striking difference between the varieties was noticeable at the first glance. The Lawrence pear trees, numerously represented in the orchard, were as a rule not at all infested, and only on a few trees isolated specimens were seen, usually on the fruit. In striking contrast to the Lawrence pear is the Duchesse d'Angoulême and derived varieties. Many trees of this variety are in all parts of the orchard, and every one of them is badly infested. The Bartlett pear and allied varieties are also uniformly infested, but decidedly less so than the Duchesse pears.

No trace of scales could be found on the Raspberry bushes, but most of the few remaining currant bushes were badly infested. Finally, scales were found on the few rosebushes in the orchard, but a single specimen of a rose with very rough and spiny surface (*Rosa rugosa?*) was perfectly free of them. All other plants, cultivated or wild, growing within the orchard, were absolutely free from the scales.

OTHER INFESTED PLACES.

Not a single scale could be found on the grapevines of Dr. Hedges' extended vineyard, although, as stated above, it immediately adjoins the infested pear orchard. Within this vineyard, and planted between

the trellis of the grapevines, is Dr. Hedges' second pear orchard. This is only about 200 feet distant from the infested orchard, but considerably lower than the latter, and proved to be absolutely free from scales. A careful examination was made of all trees (apple, peach, pear, oak, chestnut) on the lawn which joins the infested orchard on the north side, but no trace of the scale could be found here. Under the kind guidance of Dr. Hedges the orchards north and northeast of the infested place were visited and carefully examined. As a result it may safely be asserted that the Scale has not yet spread from the infested orchard in three directions, viz, north, east, and west. The only exception is formed by a little Purple Plum tree (not quite 3 feet high), which stands between the orchard and the main street (about 8 feet distant from the former), and which is badly infested. A Magnolia tree and a Weeping Elm close by are not infested.

Toward the south side, however, the insect was found to have spread into the adjoining garden belonging to Judge Reeves. This is a flower garden rather than an orchard, but contains various fruit trees, which are much older than those in Dr. Hedges' orchard. Scales in moderate number were found here on a peach tree, some pear trees (a sort of Bartlett pear), and on two rosebushes. There were none on the apple trees, nor could any be seen on other cultivated plants. Adjoining this garden further south is that belonging to Mr. Robertson, and here only a few specimens of the scale could be found on a single pear tree. Beyond this point the insect could not be traced further in any direction. The apple trees (all old trees) at the foot of the ridge south of this garden were examined without success, as well as many pear trees growing in gardens in the city, and more especially some gardens near the depot (2 miles from Dr. Hedges' place).

There can not be the slightest doubt that Dr. Hedges' orchard is the focus from which the Scale has spread somewhat in a southerly direction. There can not further be any doubt that the Scale is a recent importation, as is evident from the small area occupied by it, and further from the fact that the insect has not yet acquired that polyphagous habit which it possesses on the Pacific Coast.

Regarding the mode of importation nothing definite could be ascertained. Dr. Hedges has never bought any nursery stock or other plants from California; his oldest trees were purchased eight years ago from a New York nursery; other trees were bought three years ago from the Berckmans nurseries at Augusta, Ga., and about two years ago another lot of trees was obtained from a nursery at Crozet, Va. I suggested to Dr. Hedges that the trees from the latter source may have been infested, since the time when they were set out coincides with the time when the Scale was first noticed in the orchard; but he is positive that these trees were at first not infested and that the Scales were first noticed by him at another place in his orchard among his oldest pear trees, which stand near the old currant patch mentioned above. These

currant plants were purchased eight years ago from a New Jersey nursery. In the course of time Dr. Hedges noticed that the currant bushes were dying from the effects of what he believes to have been a Scale insect. Most of his bushes were therefore dug up, but this was long before the Scales were noticed on the pear trees. It appears to be highly improbable that the Scales were introduced on these currant bushes eight years ago because the whole orchard would no doubt have been infested long ago; and from the same reason the assumption that the Scale had been introduced with the original set of pear trees must be rejected. It is of course possible that the Scale came on the young trees bought at Augusta, Ga., or Crozet, Va., but this assumption can not be proven. At any rate it would appear that another mode of importation, viz, with California fruits, and more especially pears, is much more probable in this instance than the importation with nursery stock. Dr. Hedges informed me that in the fruit stores of Charlottesville California pears are sold just as in other Eastern cities, and the newsboy on the Richmond and Danville Railroad train told me that he had often California pears for sale. It is quite evident that specimens of this Scale are frequently brought with fruit, and more especially pears, from California to the Atlantic coast, although there is no record of this fact and it is generally denied.* It is equally evident that the chances of a permanent introduction of the Scale into the Atlantic States are very small; otherwise the insect would have made its appearance with us long ago and at many places. Nevertheless, its introduction in this way is by no means impossible, and in the Charlottesville case several combinations were exceptionally favorable to such introduction. Dr. Hedges' orchard, which contains many pear trees of just such varieties as are the favorite food of the Aspidiotus, is situated close to a much-frequented highway from which the rejected parts of a pear can be easily thrown into the orchard.

HABITS OF THE SCALE.

The habits of the Scale are presumably the same as they are in California, the most striking feature being its tendency to infest only the extremities of the tree. On most trees (excepting the Duchesse and Bartlett varieties) Scales are only on the fruit and on no other part of the tree but even in the worst affected varieties the top of the tree is much less infested than the lower branches. If the Scales are solitary on the pears the reddish ring which usually (not always) surrounds each individual Scale forms a very conspicuous object. The large diameter of the ring contrasts strongly with the small size of the Scale itself which usually occupies a small depression. This last is too shallow and indefinite to be seen but its existence becomes at once apparent if one attempts to remove the Scale with the finger.

*Scales are often found in the cavity of the calyx of the fruit where they can not be seen and from which place they can not be removed by brushing or rubbing.

Pears or branches thickly covered with the Scale occur only on the Bartlett and Duchesse d'Angoulême and derived varieties. Such pears usually show more or less extended longitudinal cracks, and, at the time of my visit, were dropping to the ground by the hundreds.

The appearance of the Scale on the twigs offers no special features; this year's growth is by far the worst infested, and there are only a few trees of which the older branches are infested.

The two varieties of pear trees just mentioned are the only plants where the Scales affect the leaves. Here either one or two or more quite regular rows of Scales are along the midrib (on both sides of the same), always on the upper surface of the leaf. On badly infested trees there are similar rows of Scales on the side ribs. It was noticed that among the Scales on the leaves there are proportionally many more male Scales than among those on other parts of the trees. The infested leaves do not appear to have the tendency to drop, but their color turns to a purplish brown.

The larvæ of the Aspidiotus were very abundant at the time of my visit, crawling about with great activity. Among those on the trees the tendency is noticeable to proceed to the extremities of the twigs, leaves, and fruit. Those crawling about on the ground among the fallen pears move considerably slower than those on the trees and certainly not in a definite direction. They are seen to ascend the few grasses, purslane, and other low plants that come in their way, while others are seen to descend again. The bright yellow color of the larvæ renders them easily visible, and even when still under the mother Scale they are so large as to be readily seen with the naked eye. There are usually only one or two young larvæ under one parent Scale, and since no eggs could be found under the many female Scales I examined it would appear that the species is viviparous, the larvæ hatching gradually. The appearance of many infested pears, which are densely and *evenly* covered with the Scales, further suggests that this gradual hatching of the larvæ has been going on uninterruptedly since several months, probably since the time when the fruits commenced to be formed; in other words, that there is in this species no succession of generations with definite intervals.

I failed to find or see a single male, but whether none existed during the time of my visit (August 17 and 18) or whether I overlooked them can not be decided.

ENEMIES.

Whether or not this colony of *Aspidiotus perniciosus* at Charlottesville is already infested by parasites was not ascertained during my visit. Several badly infested pears were carefully examined, but no exit holes of Chalcids were seen on the Scales. Only a few other species of insects were seen on the trees, of which only the following have any connection with the Scale: *Collops 4-maculatus* was present

in small number of specimens, but all being engaged in feeding upon the Aspidiotus larvæ. Whether or not they feed also upon the Scales themselves has not been ascertained. *Pentilia misella* (family *Coccinellidæ*) and its larvæ are very abundant on the infested trees and constitute an important enemy of the Scale. The imagos seem to prefer the full-grown female Scales, and the attitude they assume in attacking the same is quite peculiar. They stand astride over the Scale and elevate the posterior part of the body until they assume a nearly vertical position, being supported only by the head and the hind legs, which are extended to their full length. During this operation the head is pushed under the margin of the Scale. Thus practically standing upon their heads the beetles devour the contents of the Scale. The larvæ of the Pentilia were observed to feed on the Aspidiotus larvæ, and their mode of lifting up the Scales was not ascertained. No eggs of this useful little Coccinellid could be seen, and at first no pupæ were found until it was ascertained that the place of pupation is within the calyx of the pears. This cavity is always literally filled with a mixture of young and old Aspidiotus, full-grown Pentilia larvæ, their pupæ, and freshly issued imagos. But (as already observed by Mr. Hubbard) these Coccinellid beetles also serve as a means of transporting the Aspidiotus larvæ, and it is quite difficult to find one of these beetles which does not carry on its back at least one specimen. Sometimes three or four Aspidiotus larvæ may be seen on a single elytron of a Pentilia.

A small, black, shining ant (*Monomorium minutum*) is extremely abundant on the infested pears, evidently being attracted by the saccharine excretion exuded from the cracks of the fruits. It has no connection with the Scale, but almost every specimen carries on the back one or more specimens of the Aspidiotus larvæ. A few specimens of *Typophorus canellus*, red as well as black specimens, were on the pear trees, and here it was observed that on the red specimens no Aspidiotus larvæ were carried about, while on the black specimens such larvæ were seen. This preference of the Coccid larvæ for the shining black insects is also corroborated by other instances. A large red ant (*Formica schaufussi*) is also quite abundant on the infested pears, but does not carry about any Aspidiotus larvæ; none were seen on the backs of the Collops, and only in a few instances I saw a specimen on the back of the Pentilia larva, which is of a dull olive-brown color. There were also a number of Hyphantria larvæ on the pear trees, but no Aspidiotus larvæ could be seen on them, although the web of the single nest I saw had captured a large number of young Aspidiotus.

Finally, I would state that besides this Pentilia not a single other Coccinellid could be seen on the trees, and it appears to me that the complete absence of the common *Chilocorus bivulnerus*, which is by far the most effective enemy of Scale insects in Florida, is more especially a fact worth recording.

THE SAN JOSÉ SCALE IN VIRGINIA.*

By D. W. Coquillett.

In accordance with instructions I proceeded to Charlottesville, Va., on the 11th of December, and interviewed Dr. C. H. Hedges in reference to the presence of the so-called San José Scale (*Aspidiotus perniciosus*) in the orchards in the vicinity of Charlottesville.

A careful examination of the fruit and ornamental trees and shrubs on his place revealed the fact that as yet this pest was confined to the orchard of about 1¼ acres on the south side of his place, and to two peach and one Japanese plum trees near his barn, at a distance of about 150 yards north of the orchard above described. In Judge Reeves's garden, which adjoins Dr. Hedges's infested orchard on the south, are eight or ten pear trees and a few currant bushes infested with this Scale, while just south of this, in Judge Robertson's garden, are about a dozen pear trees likewise infested. These places are situated a short distance north of the city limits of Charlottesville, and I did not find a trace of the San Jose Scale in any other orchard or garden in and about Charlottesville. To the northward I examined the trees and plants for a distance of about three-fourths of a mile, or to the woodland; to the westward I examined them to a point beyond which no fruit trees were grown for a distance of about 1½ miles; to the southward I carried the examination through the city of Charlottesville and to a point about 1 mile beyond, also following the course of the city westward to its western limit; and to the eastward I examined the trees and plants to a point beyond which no fruit trees could be seen for a distance of several miles. Besides this, I also spent a day in examining the orchards located some little distance from Charlottesville, but found no trace of the San José Scale outside of the three gardens or orchards referred to above.

Of the trees and shrubs infested with this Scale, the Pear, Peach, Plum, Apple, Currant, and Rose were the most thickly infested, the Cherry less so, while the Quince, Gooseberry, and Raspberry were comparatively free. I did not find any of these Scales on grape-vines, strawberry plants, or weeds growing near the infested trees.

As to the source from which the San José Scale was first introduced into these three orchards, it is quite impossible to determine at this late day, but it appears very evident that it made its first appearance in Dr. Hedges' orchard. It has been suggested that the infection resulted from the use of infested pears, but Dr. Hedges informed me that he has never bought any pears grown in California, or in any other region liable to be infested with these Scales, and his neighbors assured me that they had never done so. The infested trees are located

* Report of investigations made under instructions from the Entomologist.

several yards from the public road, and it would be quite impossible for any passer-by to throw parings of fruit into the orchard while passing along the road. Nor does it seem probable that the infection came from the parings of infested fruit thrown out of the car windows by the passengers as they pass Dr. Hedges' place; the railroad is several hundred yards west of his infested orchard, while between them is a pear orchard of one hundred trees which is entirely free from this Scale.

The probabilities are that some of the trees in the infested orchard were infested with San José Scale when they were first obtained from the nursery. Dr. Hedges informed me that he first noticed the characteristic pink spots on some of his pears in the summer of 1892, and these grew on trees set out in November, 1884.

A few of the infested trees are about 14 feet high, but the majority of them are under 10 feet in height. About two hundred and thirty trees in all are infested.

PYRALIDINA OF THE DEATH VALLEY EXPEDITION.

In the report on the insects of the Death Valley Expedition, published in *North American Fauna* No. 7, pp. 235–268, we mentioned but five species of Pyralids and these belonged to the family Phycitidæ. A report on other material, however, has since been received from Prof. Fernald, from which we have drawn up the following short table, which may be considered as supplementary to the list already published. Prof. Fernald's descriptions of the new species follow:

Family PYRAUSTIDÆ.

Nomophila noctuella S. V	1 ex., Argus Mountains.
Pyrausta gracilalis Hulst	6 ex., Argus Mountains.
Pyrausta lethalis Grt	11 ex., Argus Mountains.
Loxostege anartalis Grt	1 ex., Argus Mountains.
Loxostege linealis Fern. n. sp	2 ex., Argus Mountains.
Loxostege flavalis Fern. n. sp	4 ex., Argus Mountains.
Loxostege oberthuralis Fern. n. sp	3 ex., Argus Mountains.
Loxostege napæalis Hulst	4 ex., Argus Mountains.
Prorasea simalis Grt	2 ex., Argus Mountains.
Titanio nuchalis Grt	3 ex., Argus Mountains.
	2 ex., Panamint Valley.
Titanio proximalis Fern. n. sp	2 ex., Death Valley.
	3 ex., San Bernardino Co.
	1 ex., Argus Mountains.
Gen. and sp? too poor for determination	1 ex., Death Valley.
Metasia quadristrigalis Fern. n. sp	2 ex., Argus Mountains.
Metasia argalis Fern. n. sp	1 ex., Argus Mountains.
Scoparia refugalis Hulst?	1 ex., Argus Mountains.

Family PYRALIDÆ.

Stericta trabalis Grt	3 ex., Argus Mountains.

Family PHYCITIDÆ.

Phycid, gen. and sp.?	1 ex., Argus Mountains.
	1 ex. Death Valley.

Family CRAMBIDÆ.

Pseudoschœnobius opalescalis Hulst	1 ex., Argus Mountains.

DESCRIPTIONS OF PYRALIDÆ FROM THE DEATH VALLEY.

By C. H. FERNALD, *Amherst, Mass.*

Loxostege oberthuralis n. sp.

Expanse of wings, 32 mm. Head and palpi on the outside, bright reddish brown, white beneath; a white line running backward from over each eye. Thorax, pale yellowish, stained with reddish brown in front. Forewings, pale sulphur yellow, marked with reddish brown, as follows: A short stripe under the median vein at about the basal fourth of the wing and a smaller one in the middle of the cell. There is no indication of an inner cross-line, but the outer one starts from the outer fourth of the costa and gives off two small teeth outwardly, one inwardly nearly to the end of the subcostal vein, thence the line curves outwardly more than half way from the cell to the outer margin, and runs into vein 2, and after giving off a sharp outward tooth on the fold, is lost. The space between the cell and the outward curve is filled in with reddish brown, broken by two teeth of the ground color, extending inwardly from the outside, the upper and larger one extending nearly in to the middle of the end of the cell. Three geminate, wedge-shaped spots extend inward, one from the apex, and the others below it; and, below these, an ill defined band extends, parallel with the brown terminal line, to the anal angle. The fringes are pale reddish brown, divided by a darker line.

Hind wings, white, with a fuscous terminal line not reaching the anal angle within which the wing is stained by the same color; a faint trace of a cross line beyond the end of the cell. Under side of the wings and body, pale straw-yellow, the markings of the upper side of the forewings showing faintly beneath.

Described from one fresh specimen given me by Mons. Charles Oberthür, who obtained it from the late H. K. Morrison, collected in Arizona, and from a much-faded specimen in the National Museum, taken on the Argus Mountains, California, in April, 1891.

Loxostege flavalis n. sp.

Expanse of wings, 20 mm. Head, thorax, and forewings, light ocher yellow. Labial palpi, darker yellow on the outside, white beneath. The outer cross-line is represented by a row of more or less diffuse dark brown dots arising from a little beyond the middle of the hind margin, and curving outward slightly, then running up toward, but not reaching, the outer fifth of the costa. The inner cross-line is represented only by a dark brown dot on the basal third of the hind margin.

Hind wings, white, stained outwardly with very pale yellow. Under side of all the wings, very pale yellow. The cross-line of the fore wings, repeated beneath.

Described from two examples from the National Museum, taken in southern California.

Loxostege linealis n. sp.

Expanse of wings, 20 mm. Head, thorax, and palpi on the outside, light chestnut brown. Palpi, white beneath, and a white line over each eye, which extends forward and around the frontal projection.

Forewings, dark brown, chestnut brown on the basal part of the costa, and overlaid to a great extent with white scales, especially along the veins which are indicated by white lines. The inner cross-line is not indicated. The outer cross-line is white, nearly parallel with the outer border, and nearer to it than to the end of the cell, wider on the costa than elsewhere, and not quite reaching the hind margin. Terminal line, dark brown, bordered on the inside by a wider white line.

Fringes, pale yellowish, with a darker line through the basal part.

Hind wings, light ash gray, with a darker terminal line preceded by a light line, neither of which reaches the anal angle. The outer cross-line, which is scarcely visible, extends from the outer fourth of the costa nearly straight to a spot near the end of vein 2.

Fringes white, with an ash gray line near the base.

Under side of the fore wings, ash gray, lighter on the costa and beyond the cross-line, which shows faintly. Under side of hind wings silvery white, grayish along the costal portion; the beginning of a cross-line on the outer fourth of the costa. All the wings have a terminal row of dark points beneath; those of the hind wings do not reach the anal angle. Under side of the body and of the legs silvery white.

Described from one example in the National Museum, taken on the Argus Mountains, California, in April, 1891.

Titanio proximalis n. sp.

Expanse of wings, from 20 to 25 mm. Head, thorax, upper side of abdomen, and fore wings dark brown, overlaid more or less with whitish scales. The outer cross-line is represented by an ill-defined, dentate, dark brown line crossing the wing about halfway between the end of the cell and the outer border, and bent in below the cell. This line is margined imperfectly with cream white.

Hind wings, orange red, with a narrow, terminal, dark brown border.

Fringes of the same color as the border.

Under side of all the wings orange red, with brown fringes, and an oblique brown streak on the cross-vein.

A variety of this species has the hind wings orange yellow. It was taken on the Argus Mountains, California, April, 1891.

One example in my collection and two in the collection of the National Museum, collected in San Bernardino County, Cal.

This species is most nearly allied to *Titanio superba*, of Europe.

Metasia argalis n. sp.

Expanse of wings, 20 mm. Head, thorax, and fore wings straw yellow, sprinkled more or less with brownish scales. Labial palpi brown on the outside and white beneath.

The fore wings have the base, above the median vein out as far as the inner cross-line, thickly sprinkled with brown scales. The cross-line is oblique to the median vein, where it bends and runs nearly at right angles to the hind margin. The orbicular and reniform are strongly marked, and sprinkled within with brown scales; the former is slightly oblique; the latter straight on the inner side, and with a short, blunt outward tooth at the end of the subcostal vein. The outer cross-line starts from a point on the costa halfway between the reniform spot and the apex, and runs parallel to the outer margin, to a point between veins 5 and 6, giving off a single blunt tooth in the middle of its course, then, curving around beneath and touching the lower end of the reniform, continues obliquely inward and downward to a point below the orbicular on the fold, then runs to a point near the outer fourth of the hind margin, forming an inward angle on the fold and an outward angle on vein 1. The terminal space is sprinkled with brown scales quite densely along the inner edge, and especially below the cell, and is separated from the cross-line by a narrow clear

space. The terminal line is dark brown and broken. Fringes pale straw-yellow, mixed with brown scales.

Hind wings white, with a brown discal spot near the middle, and a brown cross-line extending from the outer third of the costa to a point beyond the end of the median vein, thence to the origin of vein 2, where it turns and runs to the margin within the anal angle. This line is obliterated at the beginning and on the median vein, elsewhere it is wavy in its course. The terminal space is sprinkled with brown atoms, leaving a clear space along the outside of the cross-line, widest behind the cell and towards the costa.

Fringes white, mixed with brown scales.

Under side of body and wings white, the latter showing the markings of the upper side more or less clearly; fore wings sprinkled with brown through the middle and in the terminal space. Legs white, the fore tibiæ brown on the outside.

Described from one specimen in the National Museum, taken on the Argus Mountains, California, April, 1891.

Metasia quadristrigalis n. sp.

Expanse of wings, 19 mm. Head, thorax, and upper side of fore wings yellowish brown, sprinkled with dark brown atoms, giving to these parts a dark, yellowish brown appearance. Palpi, darker on the outside than the head, and white beneath. Two white lines cross each fore wing. The inner line starts from the basal fourth of the costa, runs obliquely to the middle of the cell, where it turns at nearly a right angle and runs in a more or less zigzag course to the basal third of the hind margin. The outer line starts from the outer fourth of the costa, runs obliquely to a point nearly halfway between the end of the cell and the outer margin, thence runs to the outer fourth of the hind margin, curving slightly inward in its course. The reniform spot is very slightly indicated by a few dark brown scales on the end of the cell. The extreme edge of the outer half of the costa is marked with white and dark brown alternately. Fringes slightly darker than the surface of the wings.

Hind wings brownish, about as dark as the forewings, but without the yellowish tint, and with a row of faint dots along the outer edge. Under side of fore wings, grayish fuscous, whitish along the costa, and with four equidistant, dark brown spots on the outer half. The outer line is faintly indicated in dark brown, and there is a terminal row of dark dots. Under side of hind wings much lighter, coarsely sprinkled with brown, especially on the costal half, and a terminal row of brown dots and an outer curved cross-line starting from a brown spot on the outer third of the costa.

Described from one specimen in the National Museum, taken on the Argus Mountains, California, April, 1891.

ENTOMOLOGICAL MEMORANDA FOR 1893.

By Mary E. Murtfeldt, *Kirkwood, Mo.*

Disappearance of the Web-worm Tiger around St. Louis.—Among the insects which I, in vain, endeavored to collect during the past season was the valiant little Carabid *Plochionus timidus.* From dozens of Web-worm nests examined, both of the first and second broods, not a larva could be obtained. The result of the disappearance—temporary, it is to be hoped—of this important check on the development of *Hyphantria cunea* was noticeable in the unusual numbers of the second brood. I am at a loss to what to attribute the scarcity of the Carabid

unless to the excessive rains of the spring and early summer, which must have destroyed a large proportion of the insects that are habitually upon or beneath the surface of the earth.

The Rust-red Social Wasp an Enemy of the Web-worm.—While holding in my hands, for examination, a detached nest of *Hyphantria cunea*, in which the larvæ were about two-thirds grown, one of the above-named wasps alighted upon it and, tearing away a portion of the web, seized one of the worms between its feet, and driving its sting into the thoracic region, grasped the neck with its jaws and rose into the air, carrying its struggling victim with it. If I do not mistake, this wasp has not hitherto been included among the numerous species that prey upon the Web-worm.

Anthrenus varius on Blossoms of Viburnum.—I was much surprised to find, last spring, while noting the insects that were attracted to the corymbs of *Viburnum prunifolium*, that the small Dermestid above named was present in very large numbers, apparently outnumbering all other species combined. I have occasionally found the beetles of this group upon flowers, especially upon Spireas, but do not remember ever to have seen this particular species so abundant out of doors.

Scutigera forceps and Callimorpha.—The food of *Scutigera forceps* was the subject of some discussion among entomologists during the past year. As a contribution to the record of its habits, permit me to say that I found an unusually large specimen one evening in July devouring a *Callimorpha lecontei*, under the full blaze of a bright hall lamp. Coming downstairs, my eye was attracted by the singular appearance on the top of the newel post. A white moth was fluttering violently in what seemed to be some sort of indistinguishable web or haze. Having a cyanide bottle at hand, it was quickly placed over the mystery, and after the fumes had quieted all action the capture proved to be a specimen of the moth above mentioned, held fast in the jaws of the Myriopod, which had already eaten quite a hole in the side of the thorax. The mist-like observation had been produced by the incredibly swift motion of its numerous, long, slender legs while struggling with its prey. At another time I saw the same species feeding upon a specimen of *C. fulvicosta*, accompanying the action with the same rapid movement of its legs.

Trapping Codling-moth Larvæ.—Late last spring some of the deluge-like rains, which visited this section of the country, were followed by hard winds and in consequence of the saturation of the soil fruit and shade trees in large numbers were blown over. In our little orchard several large apple trees were prostrated and a number of others were with difficulty kept in position by means of braces of wood and guying with wires and ropes. To prevent these from cutting into the bark large pieces of bran sacking and old cotton cloths were used as padding in the forks and against the trunks. As very little fruit had set no spraying was attempted and the few apples that developed were

attacked by worms. Walking among the trees a few days ago I made an examination of the cloths and found them all webbed in every crease and fold with hibernating Codling-moth larvæ, hundreds of them, notwithstanding the scarcity of the apple crop. These will be destroyed before spring, and it seems to me that, after all, such methods of trapping are preferable to spraying in small private fruit gardens. The advocacy of the long disused hay or paper bands for the early broods of the worms should be renewed. Or, judging from my recent observation, a wad of old rags or sacking in the forks of the trees would perhaps be as efficacious as the band and somewhat less troublesome to arrange.

A NEW SPIDER PARASITE.

By William H. Ashmead.

The very interesting contributions of Mr. L. O. Howard toward a knowledge of the Hymenopterous parasites of North American Spiders, published in Insect Life, induce me to publish here the description of a new external parasite on a spider, discovered the past summer by Mr. Trevor Kincaid, of Olympia, Wash.

This species is of more than ordinary interest from the fact that three specimens were sent, while still in the larval state, attached externally to the spider, two of which transformed to imagos virtually under my eyes, and I am therefore able to describe the different stages.

My friend, Dr. George Marx, our highest authority on the Arachnida, has kindly determined the spider on which the parasite lives as *Tetragnathus* sp., it being in too shriveled a condition to be determined specifically.

The larva of the parasite, which is elongate-fusiform in shape, narrowest toward the head, and of a greenish-white color, lies extended longitudinally along the abdomen of the spider, the head being inserted close to the base of the cephalothorax, or where the abdomen is attached to the body. All the specimens received invariably occupied this position, and when they attain full growth almost completely cover the abdomen, the latter being visible only along the lateral margins.

This longitudinal position of the larva may be assumed for protective reasons, as in this condition it is less noticeable, appearing to be a part of the spider, or resembling a longitudinal white band, often observed in various spiders.

On reaching maturity the parasite leaves the spider and forms a web, loosely constructed, in the meshes of which it weaves a very characteristic cocoon, within which it passes its final stage to the imago. This cocoon is quite distinct from all other Ichneumonid or Pimplid cocoons known to me, and more nearly resembles those made

by certain Braconidæ, belonging to the genus Bracon, only very much narrower and not nearly so strong or tough.

This new spider parasite may be recognized from the following description:

Zaglyptus kincaidii, sp. n.

Larva.—Length, 1·6 mm. In outline fusiform, widest at penultimate segment and gradually tapering toward the anterior segment; width of penultimate segment, 0·6 mm.; width of anterior segment or head, about 0·2 mm.; mandibles small, piceous; color pale greenish-white or milky-white, the derma being finely but beautifully shagreened; ultimate segment with two large piceous-black spots at base laterally, posteriorly rounded with four very minute black tubercles; a series of lateral whitish spots above the spiracular region, those on the antepenultimate segment quite large. (Larva not fully matured.)

Cocoon.—Length, 7 mm.; greatest width at the middle, 1·6 mm.; elongate, tapering toward both ends almost equally, but tetragonal and composed of fine white silk closely woven into a parchment-like consistency.

Imago.—♀. Length, 4·5 mm.; ovipositor, 0·6 mm. Polished black, impunctate; mandibles, palpi, tegulæ, anterior and middle coxæ and trochanters, apex of middle and hind femora, basal two-thirds of middle tibiæ, broad band on hind tibiæ and basal half of basal joint of middle and hind tarsi white; apex of hind tibiæ black; rest of legs, except middle and hind tarsi, which are fuscous, reddish-yellow; fifth tarsal joint swollen.

Antennæ nearly as long as the body, black or brown-black, the apical edge of scape and pedicel pale. Mesonotum trilobed, the lobes convex; mesopleura with a femoral fovea posteriorly, polished; scutellum impressed at base, subtriangularly elevated posteriorly, smooth; metathorax longer than wide, delicately areolated, the pleura finely punctulate. Wings hyaline, strongly iridescent, the stigma and venation dark brown. Abdomen polished, much longer than the head and thorax united, with a short, reflexed ovipositor that is not longer than the first segment; segments 2 to 5 with a slight transverse impression and with a more or less distinct lateral impression; the concave venter whitish.

♂. Length, 4 mm. Differs from ♀ only in the usual sexual difference, and in having the scape and pedicel beneath wholly white, the flagellum black, the middle tarsi subfuscous, while the surface of the metathorax is finely rugulose and distinctly areolated.

HABITAT—Olympia, Wash.

Described from one ♂ and one ♀ specimen, bred from a spider, *Tetragnathus* sp., discovered by Mr. Trevor Kincaid, in honor of whom the species is named.

NOTES ON SCOLYTIDÆ AND THEIR FOOD-PLANTS.

By W. F. H. BLANDFORD, *Lecturer on Entomology in the Forestry School, Royal Indian Engineering College, London, England.*

For practical purposes the Scolytidæ may be divided according to their habits into four groups. Of these the first and most important is that to which the name Bark-beetles (*Borken-käfer*) properly applies; the females tunnel galleries in the inner bark or sap-wood of trees, from which the larvæ mine separate burrows, or more rarely clear away

patches of the surrounding tissues by advancing in an irregular column (e. g., *Dendroctonus micans*); the imagos when mature emerge through the bark by separate flight holes.

Of the one hundred and thirty or more European species at least one hundred and six are known or may be assumed to possess such habits.

In the Tomicini and Platypini we meet with divergences from the normal mode of life. The females of all Platypini whose habits are known, and of certain genera, Trypodendron, Xyleborus, etc., among the Tomicini bore deeply into wood, in the recesses of which the larvæ develop. In Trypodendron the larval galleries persist as short blind chambers, indicating that this mode of life is an adaptation from the primitive subcortical habit.

The Xylebori have gone a step farther, their larvæ having as a rule abandoned the construction of galleries for themselves, and lying in and feeding on the contents of the mother burrows. They are further distinguished by the stunted and flightless condition of the males, which are rarer than the females, a feature not found in the less specialized Trypodendra.

The larvæ of *X. cœlatus* Eichh., are subcortical miners, but the published figures of the insect, and the description given by Eichhoff, Le Conte, and others indicate, as do its habits, that it should be referred to the genus Tomicus, where Eichhoff has placed it. The wood-boring habit is correlated with a different structure of the maxillæ, which are fringed with hairs instead of the flat spines found in phlœophagous species, and the two modes of life, associated as they are with structural differences, are unlikely to occur in the same genus. The generic names of American Scolytids are by no means in accordance with those used by European coleopterists who have investigated the structure of the mouth-parts, a point which widely separates the species of Gnathotrichus (*materiarius*, *retusus*, etc.) from the bark-feeding Pityophthori, with which they were associated by Le Conte. Fourteen European Scolytids are wood-borers, but in tropical countries the proportion of wood-borers to bark-feeders is much greater, and perhaps the former preponderate.

A third habit, characteristic of certain Cryphali and Cryphalus-like forms (usually bark-feeders) and of Coccotrypes is that of burrowing, in the manner of Anobiids into seeds, roots, and other hard substances, such as book-bindings. Examples are to be found in *Cryphalus jalappæ* and *Hypothenemus eruditus*. No European species live in this way except such as have been imported from time to time in their food materials.

Lastly, a few Tomicini attack the softer chlorophyll-containing tissues, usually the stems, of herbaceous plants. This class of injuries is a modification of either of the three preceding life habits, and is of some interest. As yet little is known about it.

In Europe the genus Thamnurgus breeds in the stems of various species of Euphorbia, of Delphinium, Origanum and Teucrium, and according to Perris, the females do not burrow, but lay their eggs in wounds gnawed on the outside of the stem; in this genus the asperities on the front of the prothorax have completely dissapeared.

In Burma a species which I have identified as *Platydactylus sexspinosus* Motsch (Ind. Mus. Notes, III, 1, 64), injures rice by boring into the stalks, and has been known to destroy a field of an acre (*loc. cit.* I, 1, 61). This attack on the thin stem of a cereal, a very different thing from that of *Xyleborus perforans* on the woody sugar-cane, is so remarkable, and the insect, common in collections from Ceylon and the Malay Archipelago, is of so singular a form, that it is to be regretted that no further information has come to hand. The mode of larval life is unknown, and it is impossible to conjecture whether the larva is destructive or whether the beetle alone is responsible for the damage and breeds in other material, as is the case with *Myelophilus piniperda* and its attacks on pine shoots.

Two undescribed instances of depredations on soft tissues have come under my notice.

In the early part of this year I received from Mr. C. A. Barber, superintendent of the botanical department of the Leeward Islands, through Mr. T. D. A. Cockerell, specimens of a small Tomicine which had injured the young leaves of sugar-cane in Nevis, West Indies.

Three beetles alone were sent, belonging to two species, and no specimens of the injured leaves.

A demand for more material brought specimens of the leaves with beetle-holes and burrows, and of the insects preserved in alcohol.

The offender is *Hypothenemus eruditus* Westw. The examples show certain differences from the type, but not of sufficient importance to indicate a new species. The diversity of color is strongly marked, the posterior part of the head, the prothorax, and limbs being testaceous, the rest piceous; the prothorax is more convex, the disk less depressed on either side, its asperities few, very large, and piceous at the tip, the anterior border with but four or five well-marked tubercles; the length averages 1·4 mm. The color and sparse tuberculation of the thorax give it a very different appearance to the unicolorous *Hypothenemus aspericollis* Woll, from the Canaries, which Dr. Sharp regards as the same species, and in which the thoracic tubercles are numerous and smaller. But I agree with the latter and other zoologists as to its variability, and it appears desirable that these separate forms shall not be regarded as specifically distinct unless they coexist in the same country.

Two structural points deserve notice.

There is some doubt as to the number of joints in the antennal funiculus of *H. eruditus*. Westwood describes and figures three, indicating one suture in the distal division. Eichhoff, while admitting its possible

identity with *Stephanoderes areccæ*, Hornung (since confirmed by Fauvel), points out that the number of joints in the funiculus required by his genus Stephanoderes is five. According to Le Conte *H. hispidulus*, perhaps a form of *H. eruditus*, has but one division in the outer part of the funiculus, which agrees with Westwood's statement. In a Nevis specimen I have found two divisions, so that the funiculus is four-jointed. It is probable, as Le Conte points out, that the number of joints is of no value as a generic character for Hypothenemus; but it will be remarkable if it is found to vary within the limits of a single species.

The other point concerns the position of the head with regard to the prothorax. Le Conte hesitates to identify two American Hypothenemi with species of Stephanoderes described by Eichhoff on account of the head not being retracted into the prothorax as required by the description of the latter genus. But this, whether good or bad, depends on other characters than the position of the head, which merely serves as a point of departure between those Tomicini, such as Aphanarthrum, in which a rostellum is present, and the majority in which it is absent. The position of the head depends very much on the way the specimens are killed and mounted; it is prominent in those preserved in alchohol. Schwarz (Bull. Brook. Ent. Soc., VII, p. 84,) says of *H. eruditus:* "Not rarely specimens occur in which the head is protruded and thus apparently not covered by the prothorax. Upon such specimens Mr. Eichhoff seems to have established his genus Stephanoderes." This is a misunderstanding, and indeed a reversal of Eichhoff's position.

H. eruditus attacks the youngest cane-leaves while they are still rolled in a spike, perforating them transversely, so that the leaves when unrolled show a series of holes which form parts of a single burrow. Two or three specimens exhibit nothing but these transverse burrows. In two others a rib has been reached, and its contents excavated so as to form an irregular chamber, in one case five-eighths of an inch, in the other 1 inch long. The chambers contained one or two beetles and several nearly full-grown larvæ, which lay in the main excavation like those of Xylebori and did not construct separate burrows. They may however have enlarged the cavity, the walls of which were irregular and ragged. There were no holes communicating with the outside except the entrance hole, nor any sign of the immature beetles having tunneled the leaf-tissues.

The attacked leaves showed no signs of injury beyond that due to the beetles, they were not dry or shriveled, and I do not doubt that Mr. Barber would have noticed any abnormal condition preceding the attack. Round the holes the tissues are brown and discolored, particularly near the brood-chambers, which hollow out the ribs so as to seriously interfere with, if not to destroy, the nutrition of the parts beyond the point of attack.

No details have been sent about the circumstances of this infestation which would enable proper treatment to be suggested. It is pos-

sible that a *weak* arsenical spray applied to the leaf-shoots will ward it off.

This tendency of *H. eruditus* to attack young unopened leaves is noticeable, as it has hitherto been found in dry substances, betel, book-bindings, the dead twigs of orange and vine, according to Hubbard (Ins. Orange, p. 173) sedulously avoiding any part of the tree so long as it retains its sap or remains moist.

The other species to which I have referred I received from a gentleman who informed me that it had been very destructive to some newly imported Dendrobiums in his orchid-house. It attacked the bulbs, aerial roots, and stems, from which I extracted several females, one male, and larvæ. The parts injured were about one-sixth of an inch in diameter, and were channeled out by longitudinal burrows. The nurseryman who imported the Orchids has informed me that the species in question came from New Guinea. I have reason to believe, though he has not informed me himself of the fact, that the insect has been destructive in his houses, and I can not feel sure that it has been confined to its native species. Under the circumstances I can not be sure of its original locality. It is closely allied to *X. curtulus* Eichh., from which I could not separate it by description, but recently I have examined the type of the latter insect, which obviously differs in points not brought out in the description. The only other species of close resemblance to these two *Xylebori* is *X. compactus* from Japan. They form a somewhat distinct group.

Xyleborus morigerus n. sp.

Brevis, compacta, cylindrica, nitida, ferruginea elytris nonnunquam utrinque plagâ discoidali piceā, parce pilosa, thorace subgloboso, antice rugis transversis exasperato, margine apicali tuberculato, postice lævi, parce punctato, supra scutellum plaga pilosa ornato; elytris valde convexis versus apicem rotundatis-declivibus, subtilissime lineato-punctatis, interstitiis in declivitate pilis uniseriatis setulosis.*

Long. 1·8mm.

Mas. Minutissimus, depressus, pallide testaceus, longe pilosus, thorace lateribus valde rotundatis, angulis posticis obtusis, antice tuberculato, postice subtilissime punctato; elytris ovalibus, depressis, fortiter ac irregulariter punctatis.

Long. vix 1mm.

Hab. incert.; in caulibus orchidum ex Nova Guinea invectarum habitans.

Bright ferruginous brown, in most specimens with a well-marked blackish, discoidal patch on each elytron. Head finely alutaceous, with very short pubescence, eyes deeply emarginate. Thorax transverse, slightly narrowed at base, base bisinuate, its angles obtuse, sides and apex strongly rounded, apical margin with six or seven tubercles; disk convex, not gibbous, anterior half pubescent and with concentric rows of asperities, posterior half smooth shining, with scattered fine punctures, and a median patch of pubescence above scutellum, which is small, cordate, and smooth. Elytra as wide as thorax at base and half as long again, sides straight to near apex, then abruptly and strongly rounded, very convex to middle, which is elevated, thence strongly declivous to apex; finely punctured in lines, punctures shallow, interstices flat, with a single row of punctures as numerous but finer than those of striæ, glabrous to middle, thence bearing a single row of longish hairs.

* It seems logical to me to describe *Xylebori* which is always done from the ♀ in the feminine; if the usual manner is preferred, the genders can easily be changed.

Male.—Very small, flattened, oval, testaceous yellow, with long sparse yellowish pubescence. Head alutaceous, impunctate except over mouth, eyes oblong oval, black, entire. Thorax broader than long, widest just before base, narrowed to apex, sides from widest part and apex uniformly rounded, basal angles broadly rounded, base bisinuate, disc but slightly convex, flattened in middle, anteriorly with faint traces of asperation, posteriorly with very fine scattered punctuation covered with scattered pubescence. Elytra narrower at base than thorax, and half as long again, slightly dilated behind middle, numeral angles obsolete, rounded, sides elliptically rounded to apex; disk declivous from middle to apex. The angle of the declivity rounded, with strong scattered punctuation, the interstices slightly rugose, striae entirely obsolete, sutural margin raised posteriorly, legs long, anterior tibiæ slightly dilated at apex with two almost obsolete spines on outer margin. Length 1 mm.

As compared with *X. curtulus* this species is larger, especially broader, and more brightly colored; the hairs at the base of the thorax are shorter and less conspicuous, the elytra are shorter in proportion to the thorax, more finely punctured, and the interstices are not pubescent before the middle, whereas in *X. curtulus* they are pubescent for their whole length.

The peculiar circumstances under which this insect has depredated render it easy to get rid of by the timely sacrifice of the attacked parts of the orchids. This has had to be freely carried out by the sender of the specimens.

The few examples I have here recorded of Scolytid injury to the soft parts of plants agree in the damage being confined to the stem or the fibrovascular parts. Damage to the parenchyma of leaves, except by the burrows made by *H. eruditus* to reach the ribs, is as yet unknown.

EXTRACTS FROM CORRESPONDENCE.

Syrian Book-worms.

I send with this a live book-worm, which I found last week in an old manuscript which I recently brought from Syria. A careful search through the numerous Arabic and Syrian manuscripts in my possession might perhaps reveal others, though I have tried to get rid of them, and once in Sidon found three specimens in a single book.

I also inclose a clipping from the *New York Sun* of the 31st ultimo. Trusting to my memory I would say that the figure "Mr. R. Hooke's Bookworm" represents an insect very common in Syria, and there called *smer-keh*. The houses, especially in closets, behind pictures hanging on the walls, etc., swarm with them. They are troublesome in libraries, but generally, if not always, begin their attacks from the outside. They eat the covers of the paper-bound books and the outer leaves of unbound books and loose papers. They may eat through a few leaves, but never burrow through a great number in the style of the worm which I inclose. I have also seen cloth-bound books which they were accused of having defaced—with how much truth I can not say from my own experience—and which, while none of the cloth was eaten, looked as though the creatures had a great fondness for the coloring matter or the sizing of the binding. I found that my library was perfectly protected against the *smer-keh* by first freeing the books and cases of all specimens and then standing the cases a short distance, say half an inch, from the wall. The insects get into the bookcases and wardrobes from the walls and not from the floors. * * *—[William S. Watson, New Jersey, August 30, 1892.

REPLY.— * * * The insect proves to be a Tineid larva not represented in the collection of the National Museum. Your account of your experience with it in Syria is an interesting one. While knowing nothing of the habits of the insect in question other than what you have told me, I should say that the remedy ordinarily used against book mites, namely, the abundant application of pyrethrum powder, would avail against it. Most book mites and pests affecting libraries and records are chiefly injurious in moist situations, and, if care be taken in the matter of dryness in libraries and on bookshelves, the danger is much lessened.—[September 2, 1892.]

The Cheese Skipper Injuring Hams.

There was an interesting article in last INSECT LIFE on "The cheese or meat skippers," but the author does not state whether the young skippers are able to penetrate the bags in which hams are put; if they can, there is no use in taking the trouble to bag them.

We smoke the bacon almost a month with hickory chip fires, occasionally using sulphur; about March 1 we bag them, rubbing them over with black pepper before putting in bags. If after hot weather comes on we find any skippers, we sun them, which brings the skipper to the surface and kills them. We smoke occasionally with sulphur during the summer on still damp days. But with all this care we find some hams injured, especially if mice have cut holes in bags and meat.

Skippers do not attack shoulders or middlings to any extent; we do not bag these. If they only attack smoked meat had we not better omit smoking, the value of which is doubtful?

I think that Cincinnati ham-curers dip their hams in pyroligneous acid.—[A. G. Grinnan, Virginia, December 25, 1893.

Vegetarian Mosquitoes.

I have just read a notice by A. A. Eaton, of California, concerning vegetarian mosquitoes. I have often seen mosquitoes feeding on vegetable substances here. The first I particularly remember was about fifteen years ago, when I noticed that the rinds of some watermelons that had just been removed from the table were thickly covered with mosquitoes, evidently highly enjoying their desert. Since then I have frequently seen mosquitoes on cut fruit, though I do not think I ever saw them puncture the rind.—[Frances M. Slack, Massachusetts, October 13, 1893.

A Cat Warble.

I write to inquire concerning an insect the larva of which is parasitic on cats. I have only observed one case, the description of which is as follows: The larva is oval in shape, about an inch or seven-tenths of an inch long, and at least three-tenths of an inch thick. The color would be white, but the insect is covered with small black excrescences, and so appears brownish black. It burrows under (or perhaps the egg is laid under) the skin, in exactly the same manner as the larva of the common "gad-fly" does on cattle. In the one case I have seen, the location of the insect was on the belly of the cat, but I have been told of a case where the larva was in the eye-lid. I have also been told that what appears to be the same insect is often noted as parasitic on the gray squirrel—[Barry C. Hawkins, North Carolina, September 8, 1893.

REPLY.—I have never heard of a subcutaneous bot in the domestic cat before, and without seeing the larva or the fly can not determine the species. It is likely that it may be the same species which commonly affects squirrels and gophers throughout this country, viz, *Cuterebra emasculator* Fitch, an account of which you will find in INSECT LIFE, Vol. I, p. 214, a copy of which is sent you by accompanying mail. It may, however, be the Rabbit Bot (*Cuterebra cuniculi*), or still another species. The facts which you give are very interesting, and if you can secure specimens of this larva it will give us great pleasure to examine it.—[September 13, 1893.]

The Blood-sucking Cone-nose again

Inclosed you will find an insect that I would like to know something about. It was found under the following circumstances: About 1:15 a. m., August 16, 1893, I was aroused from my sleep by my wife's heavy breathing. On questioning her, she complained of severe headache and a sensation of swelling about the face, which rapidly spread to all parts of the body, and the itching becoming unbearable, sickness at the stomach and vomiting followed; the body and limbs broke out with red blotches, welts, or eruptions, like a severe case of measles. By bathing her freely with sweet oil she went to sleep in about fifteen minutes, and all signs of the poison disappeared except the pallid expression of the face and a slight swelling on on the shoulder, where the wound was inflicted by the bite or sting. When I first awoke I made a search for insects and found this one on her pillow. Two years ago she nearly died with the same symptoms, and the next morning two large insects, the same as this, were found on the bed, and, when killed, were found to be full of blood. I therefore suspect this fellow of being somewhat dangerous. If you can tell us whether we can attribute the sickness to this insect, you will do us a favor.—[J. L. Hathaway, Arizona, to Prof. J. W. Toumey, August 16, 1893.

REPLY to Prof. Toumey: The Conorhinus which you send has been carefully examined. It is probably one of the Mexican species of this genus, but is in too poor condition for specific determination. It differs, however, from any of the named species in the national collection. All of the species of this genus have the blood-sucking habit, and you are doubtless familiar with the accounts of *C. sanguisuga*. I see no reason to doubt the accuracy of Prof. Hathaway's account, supposing that his wife is peculiarly susceptible to disturbances of the system from insect bites. You will find in the annual report of the Entomologist for 1884, p. 414, an account by Prof. J. G. Lemmon, of California, of an experience which he and his wife had with a species of this genus, which reminds me of Prof. Hathaway's account. Prof. Lemmon's experience was in the Santa Catalina mountains of your State.—[September 14, 1893.]

Leaf-hopper Damage to Winter Grain.

I send you to-day by mail samples of flies or insects which are infesting the small grain fields in this part of the county, and which in some instances completely destroy the oats and rye. The insect appears in great numbers, and when the oats and rye are just up completely destroys them; after the grain gets good root and begins to spread out they do not kill it out so badly, but keep it from growing, and it looks sickly and small. What is the name of the insect and how can we get rid of it? In young rye planted for grass they are now in great numbers—millions—notwithstanding we have had several good frosts. I have been in several counties lately and see them everywhere, but not so numerous as on my place. In some places they have damaged the young turnips.—[L. S. Connor, South Carolina, November 20, 1893.]

REPLY.—The insects which are damaging your small grain belong to two or three different species of Leaf-hoppers, including *Diedrocephalus flavipes* Riley and *Cicadula 4-punctata* Fab. Injury of this kind is comparatively rare; but two or three cases are on record. In his annual report as entomologist of this Department for 1879, Prof. Comstock treated of the damage done by a closely allied species, *Cicadula exitiosa*, to winter wheat in your own State. You will find a full account of this occurrence in the annual report of this Department for 1879 (pp. 191–193). The damage was done during the winter of 1879–'80, and was attributed to the extremely mild season. Similar damage to wheat has occasionally been reported in parts of Europe, and in the spring of 1875 such injury was reported from certain parts of Illinois; also during the winter of 1876 from parts of Texas. Under ordinary circumstances leaf-hoppers are kept within winter quarters and many are killed by the cold weather. The only remedy which was recommended in this report was the carry-

ing of lighted torches through the fields at night and the building of bonfires at different points, with the view of attracting the leaf-hoppers to death in the flames. The *Diedrocephalus flavipes* which you send in was first described by Prof. Riley in The American Entomologist (Vol. III, p. 78). This is the species which damaged wheat fields in Texas, as above mentioned, in 1876. No remedial measures are given in connection with the description.—[December 19, 1893.]

The Egyptian Icerya in Australia.

You will be interested to hear that a short time ago Mr. W. W. Froggatt, of Sydney, sent me a number of Coccids, amongst which was one which I can not identify as anything else than *Icerya ægyptiaca* Douglas. The characteristic curling waxy processes were present; the antennæ agree exactly with the figures of Douglas and INSECT LIFE; the feet agree; the hairs and spinnereta of the body agree; and the color of the insect agrees (although to my eyes it is rather "red" than "orange"; but that is unimportant). The only discrepancy is that Douglas gives the length as one-fifth inch; my specimens are rather more than one-tenth inch; yet they are adult, having antennæ of eleven joints, but *early* adults not having formed ovisacs. I do not attach them to *I. montserratensis*, as the last antennal joint is *shorter* than the three preceding.

Among the specimens were some of the second stage ♀, with 9-jointed antennæ. Neither you nor Douglas described this.

It was my impression that perhaps these insects had been brought from Egypt to Australia in plants or flowers by steamer passengers who might have staid at Cairo or Alexandria. But on asking Mr. Froggatt to get me some more, he says in reply: "I will try to get out to where I found them, but it is a rather awkward place unless one makes a special trip for it; it is rather a settled district with old orchards within a mile or so; but they were quite in the bush and pretty plentiful." This seems to point to an indigenous habitat. May this also perhaps be an Australian Icerya?

I venture to send you this note as I see *I. ægyptiaca* has been found in India. It will be important to recollect that there is a rather large trade in horses from Australia to India, and the insect could readily have been carried in the numerous steamers plying in it.—[W. M. Maskell, New Zealand, October 22, 1893.

Damage by Locusts in Colorado.

* * * Locusts have caused hundreds of thousands of dollars of destruction; mostly in alfalfa and potatoes, and injuring wheat, oats, and barley, and orchards. They roosted in all varieties of trees to some extent, but, having abundance of the two first named plants to eat, they fed mostly on them; but to some extent they are omnivorous. They ate the leaves of apples (leaving the main rib) and girdled the limbs of plums, and in some cases the bodies of three-year olds, and cut off the leaves during the night and cloudy cool days.

Hopper dozers were used, and bran and Paris green, but these devices proved of little use, as the hatching in numbers was nearly continuous until late in September, and at this date there are quite young ones mixed with old ones. There has been also, every variety ever seen or heard of in color and size.—[E. H. Benton, Colorado, October 3, 1893.

Concerning Spider-egg Parasites.

Argiope argentata, the most beautiful of the many species of Argiope here, is very common on the Island of Catalina and the coast ranges on the mainland.

Its cocoons may be found in abundance on the common *Opuntia engelmanni*, in the months of August and September, and in examining them I found a large number of them parasitized. Of those gathered on the Island over 60 per cent were affected

with *Eupelmus piceus* Riley, and *Sarcophaga davidsonii*, Coq. Of those collected at Redondo no less than 95 per cent were parasitized—20 per cent with Sarcophaga and the remainder with Eupelmus.

I failed to collect at such an early stage as to ascertain whether the parasite deposits its eggs in those of the spider, or only among them; but of this I am sure, after hatching they eat every egg they come in contact with, and if very numerous eat yolk, membrane, and all. I kept those till they hatched and found the average time of pupation was fifteen days; some, however, have remained in the larval stage for more than a month, and may possibly remain so all winter.

The number of Eupelmi contained in some of the cocoons seems unusual; of seventeen taken at random and counted one contained one hundred and eight and the total average was sixty-six.

Of the Sarcophagæ a few hatched after ten days in the pupa stage; the others are either dead or awaiting the spring. The average number of Sarcophagæ in each cocoon was three, but many of these proved abortive, as they in their turn were affected by a species of Tetrastichus, the cocoons being literally packed full of these little insects. I counted the contents of two of them; they numbered fifty-six.

Sarcophaga davidsonii I have also found in the cocoons of *Phydippus opifex*, as has already been reported by Prof. Coquillett in INSECT LIFE, and this season, though this spider is more abundant than heretofore, yet I find not more than 10 per cent of them affected and none with epiparasites.—[Anstruther Davidson, M. D., California, October 3, 1893.

Abundance of the Red Spider in Illinois.

Since this terrible drought, which more severely affected a certain section, including this vicinity, I have noticed trees and shrubs, during hot winds from the southwest, with leaves suddenly turning as if burnt and falling off. Often alternate trees in a row are so affected. Sometimes the damage commences just above the lower clump of trees, goes right through upwards, and leaves the tree green below and above, especially northeast below and southwest above, but always beginning southwest. Today I observed a row of Sweet Pea vines similarly affected, regardless of constant watering, and soon I saw them covered with webs. I at once made my rounds, and found Cherry, Apple, Rose, Peach, Pear, Trumpet Creeper, Prickly Ash, etc., more or less affected in my own garden, and vegetation everywhere affected similarly. I give this as a sample and inclose affected leaves of *Zanthoxylum fraxinium*, Cherry and Sweet Pea vines. The webs on *Z. fraxinium* (Prickly Ash) are most severe, as stems from the ground to the tip are coated. The Sweet Pea comes next, being affected from the ground up, but the tops of these trees are still green and in bloom. The Cherries, etc., are differently affected, some more and some less, the webs being mostly on the under side of the leaves and thickest toward the wind, where the dust is filling the web and the latter is probably doubled over by the insect on that account. I also observed a large Apple tree with Trumpet Creeper running upwards on the southwest or windy side, literally covered with this fine web between the creeper, the leaves of which are still green. A large Elm near by, also with a creeper upon it, is free from the webs, but the leaves of the creeper are somewhat affected. I notice that the little spider on Prickly Ash seems longer (more oval) and lighter in color than that on Cherry, the latter being more round and darker, resembling the spider, often injurious to house plants in hot, dry, sunny rooms. In the hurry and short time of observation I noticed but one parasite which was seemingly feeding upon the spider. This was the larva of a Lace-wing Fly.—[A. H. Mundt, Illinois, September 5, 1893.

REPLY.—The leaves which you send are affected by a Red Spider of the genus Tetranychus, allied to but differing from the common Red Spider of the greenhouse (*Tetranychus telarius*). Its occurrence in your vicinity in such numbers is somewhat

unusual, although similar instances have been brought to the attention of the Division before. This mite is readily amenable to the kerosene emulsion, particularly when a small quantity of flowers of sulphur has been added.—[September 11, 1893.]

Kerosene and Animal Parasites.

I tried a little experiment during last August with our ordinary coal oil. I saw a number of my hogs were not doing well. They were continually rubbing against the fence or some post. I put one gallon of oil into my knapsack sprayer, put it on my shoulders and walked out to the pen. I could not get my hogs quiet enough to spray well, so I put some corn chop into their box, and while they were eating I gave them an excellent covering of oil, very finely put on by said sprayer. My neighbors said "The hair will come off"—others said, "It will blister." I awaited my result. Next morning on examining their backs I found great loose scales of dirt and mange, and under these and among them were thousands of dead lice. Result—my hogs are smooth and slick, lice all gone. Have tried same in hen houses to kill chicken mites, also lice on horses. A flannel cloth saturated with best coal oil and rubbed over eggs from Bot Fly on horses' legs causes eggs to loosen and drop in a short time.—[E. H. Kern, Kansas, December 30, 1893.

NOTES FROM CORRESPONDENTS.

Larvæ in a Child's Face.—A correspondent from Fort Collins, Colo., mentions a peculiar case of a child 15 days old affected with a subcutaneous larva on the right side of the face, neck, right arm, and hand. The "worms" were inclosed in indurated sacks. Thirty-two were removed and in one case four from one sack. They are described as being about 3 lines long by 1 line wide. They were segmented or ringed, white in color with light brown head, and sparsely covered with microscopic hairs.

Larval Food of Euxesta notata.—Prof. J. B. Smith recently wrote us that he had reared this Ortalid fly from Onions and asked us whether we had ever published anything concerning its larval habits, since he had noticed in a foot note to the description of this species in Vol. III of the Smithsonian Monographs of Diptera, a statement by Baron Osten Sacken that he had received specimens from us reared from larvæ in the pulp of Osage orange. Examination of our notes shows that we have reared the fly from cotton bolls from Alabama, from Sumach fruit from Virginia, from bolls of *Solanum carolinense* in the District of Columbia, from Osage oranges in Missouri, and that Mr. Coquillett has reared it from Apple previously infested by Codling Moth in California.

Change of Address.—Prof. A. J. Cook, for many years professor of entomology in the Agricultural College of Michigan, has removed to Claremont, Cal., where he is professor of zoology in Pomona College.

Abundance of the Purslane Caterpillar.—Mr. T. J. Brewster, of Lucerne, Kans., writes us that the Purslane Caterpillar was extremely abundant in his vicinity during the summer of 1893. He considers this insect a positive benefit to the farmer since it rids the land of such an obnoxious weed.

Road-dust Against Swine Lice.—Noticing on p. 165 of the last number of INSECT LIFE that road-dust is recommended by Prof. Osborn as a remedy against lice, Mr. T. J. Brewster, of Kansas, writes that the lousiest hogs he ever saw were confined in extremely dusty pens. He finds kerosene emulsion one of the most effective and cheapest of remedies.

A new Food-habit of a Clothes Moth.—We have lately received from Dr. J. C. Merrill, U. S. Army, now stationed in Washington, D. C., a can of beef meal rejected

as being "weevily." The damage was due to the presence of the larvæ of our commonest Clothes-moth, *Tinea biseliella*. This is a new but not unexpected food for this species.

A Plague of Locusts.—Mr. Erwin L. Horton reports a plague of locusts in Schuyler County, N. Y., during the past summer. He believes the species to have been the Red-legged Locust (*M. femur-rubrum*). Many of them were infested by the red mite (*Trombidium locustarum*).

GENERAL NOTES.

RECENT ENTOMOLOGICAL PUBLICATIONS OF THE U. S. NATIONAL MUSEUM.

During October and November, 1893, there were published by the U. S. National Museum three important entomological bulletins, and separates of two other entomological papers from the Proceedings.

The first to appear was Bulletin No. 44, "A Catalogue, Bibliographical and Synonymical, of the species of Moths of the Lepidopterous Superfamily Noctuidæ, found in Boreal America, with critical Notes," by John B. Smith. This is an elaborate and very useful catalogue, covering 425 pages. It is not only bibliographical and synonymical, as stated in the title, but gives the exact geographical distribution of each species and indicates the place where the type is to be found. Useful comments by the author frequently follow under the head of each species, as also an index to the authors and works cited and a general index to species and genera.

The second of the three publications is Bulletin No. 45, "Monograph of the North American Proctotrypidæ," by William H. Ashmead. This is an elaborate publication, upon which Mr. Ashmead has been working industriously for a number of years. It comprises full descriptions of all the North American forms known to him, the very great majority of which are either in the collection of the National Museum or in Mr. Ashmead's private collection. Almost the only exceptions are a few species in the Berlin Museum. The volume covers about 470 pages and is illustrated by 18 plates, upon which are figured representatives of 143 genera, one plate being devoted to details of structure. The introduction to the Monograph comprises a consideration of the external structural characters of the group, the habits of the perfect insects, an account of their transformations and life history, and their distribution, together with a running history of the previous attempts at classification. Careful tables of subfamilies and genera, as well as of species, are given. The publication of this Monograph gives American students an excellent start in an important group which has hitherto been almost entirely neglected.

The third paper forms Bulletin No. 46, and is entitled "The Myriapoda of North America," by Charles Harvey Bollman, edited by L. M.

Underwood, and contains the collected writings on North American Myriapoda, both published and unpublished, of the late C. H. Bollman. There is an introduction, with a brief biography of Mr. Bollman, by C. V. Riley; a review of the literature of the North American Myriapoda, by L. M. Underwood; a collection of Mr. Bollman's published writings on Myriapoda, including fifteen numbers, and a series of posthumous papers comprising eleven numbers. There is also an index to the scientific names, and the whole bulletin covers about 210 pages without illustrations.

The two separates from the Proceedings are Nos. 950 and 951. No. 950 consists of a "Descriptive Catalogue of the Harvest Spiders (Phalangiidæ) of Ohio," by C. M. Weed. The paper is descriptive in a large sense and brings together Mr. Weed's writings upon the Ohio Harvest Spider fauna, republishing his plates and figures, and bringing the whole matter into convenient shape for reference. No. 951 is a "Report on the Insecta, Arachnida, and Myriapoda" of the U. S Eclipse Expedition to West Africa in 1889–'90, by C. V. Riley. The paper includes reports upon the Hymenoptera, by Mr. W. F. Kirby, of the British Museum; upon the Lepidoptera, which could not be determined at the National Museum, by Rev. W. J. Holland; upon such of the Coleoptera as could not be determined in the National Museum, by Dr. David Sharp, Mr. Champion, Mr. Jacoby, and Mr. Gorham; upon the Orthoptera, by Mr. H. de Saussure; upon the Pseudoneuroptera, by Mr. P. P. Calvert; upon the Hemiptera, by Mr. A. L. Montandon, and upon the Arachnida, by Dr. George Marx and Mr. Nathan Banks. The Myriapoda were sent to Messrs. Cook and Collins, but on account of the delay in publication this portion was withdrawn by the authors and published elsewhere. New species are described by Messrs. Calvert, Banks, and Marx, the latter contributing a handsome plate illustrating a new genus and six new species of spiders.

EVOLUTION OF THE WINGS OF INSECTS.

Prof. J. H. Comstock, of Cornell University, has published an extremely interesting paper under the title "Evolution and taxonomy, an essay on the application of the theory of natural selection in the classification of animals and plants, illustrated by the study of the evolution of the wings of insects and by a contribution to the classification of the Lepidoptera." This paper is published in the Wilder Quarter Centennial Book, a "Festschrift" published the present autumn by some of the old students of Prof. Burt G. Wilder, of Cornell University. Prof. Comstock's paper is a very elaborate one and not susceptible of an appropriate review in the short space which we can devote to it. He argues that some effort should be made in the classification of species to learn the reasons for variations of form and in this way to judge the value of evident characters used in grouping or separating species and higher groups. He practically insists upon the study of phylogeny

as a ground work for taxonomy. He then makes an attempt to determine the phylogeny of the families of the Lepidoptera by a study of the structure of the wing, working carefully in the direction of the probable function of the component parts of this organ and thus reasoning as to the probable past action of natural selection. He realizes that in this study he is clearing up the history of but one element of the complex, but believes that the same lines will be found to govern in all and that an understanding of the development of one will lead in the same direction as regards classificatory results as an understanding of other structural features. His study of the wing of Lepidoptera has been made with extreme care. His conclusions as to evolutionary process may be questioned in some respects, particularly as to the distinction between generalized and specialized types, but the study as a whole is of the highest value. Applying the results of his study of the wings to a provisional classification of the Lepidoptera, he publishes a table of proposed divisions, simply as a record of the results obtained by his work. The table and the comments which follow are very suggestive, but, as a matter of course, it is too early to attempt their satisfactory use. Many interesting side points are brought out in the paper which will well repay careful study on the part of the student and more particularly on the part of the species grinder.

NOTES FROM THE MUSEUM OF THE INSTITUTE OF JAMAICA.

A number of the interesting stylograph sheets issued by the curator of the Museum of the Institute of Jamaica, Mr. C. H. T. Townsend, have reached us since the publication of our last number. These are Nos. 53 to 63. No. 52 relates to the Pimento Borer, a longicorn beetle (*Cyrtomerus pilicornis*), which bores into twigs of the Allspice (*Pimenta vulgaris*). No. 54 relates to the enemies of the Congo Pea (*Cajanus indicus*). No. 55 relates to the subject of Jamaican Ticks; No. 56 to the Isopod parasites of fishes; No. 57 to Erinose growths due to Mites; No. 58 to the Coco disease (*Peronospora trichotoma*); No. 59 to the Yellow-fever Fly, the Sciara, which is said to appear in swarms during yellow-fever epidemics. No. 60 is entitled "Grubs injuring roots of orange trees." These grubs are rhynchophorous, and belong to the genus *Præpodes.* The damage seems to be only occasional. No. 61 is called "Sand Flies and Buffalo Gnats," and is general in its character, and also asks for specimens of Jamaican Simuliidæ. No. 62 is on the Tobacco or Cigarette Beetle (*Lasioderma serricorne*), which appears to be damaging stock tobacco and cigars in the warehouses in Kingston. The recommendations which have been published in INSECT LIFE are repeated. In No. 63 the writer gives a short account of the habits of *Compsomyia macellaria*, and states that in some manuscript notes made by Mr. William Jones, between the years 1835 and 1840, the larva and adult of the Screw Worm Fly are described under the name of "the maggots of the nose," and seven cases are mentioned in which it has infested man in Jamaica.

SOME JAMAICA INSECTS.

Mr. C. H. T. Townsend has lately sent us for determination a number of interesting insects from Kingston, Jamaica, with notes on their food-habits and occurrence.

From a chrysalis found on Eucalyptus he reared *Tortrix rostrana*. A species of weevil which we have doubtfully referred to *Attelabus dentipes* Fab., was stated to injure the same tree. *Apate francisca* was found boring in Lagerstrœmia, and another Ptinid, *Dinoderus brevis* Horn, in bamboo. A Formicid locally known as the "Tom Raffles Ant" proves to be *Prenolepis fulva* Mayr. An Ephestia represented by damaged specimens, but near *elutella* Huebn., was bred from "velvet-seeds," the fruit of the old-woman's tree (*Quiina jamaicensis*). This is probably the species that had damaged the "velvet-seeds" in the Jamaican exhibit at the World's Fair, as mentioned on a previous page of this number. A similar species, also in too poor condition for identification, was reared from cacao beans and is, without doubt, the same moth mentioned under 74 in the article on the insects in the foreign exhibits at the World's Fair.

INSECT NOTES FROM TRINIDAD.

Mr. J. H. Hart, of the Botanical Department of Trinidad, has begun to issue stylograph notes on the line of those which we receive from time to time from the curator of the Museum of the Institute of Jamaica, and these occasionally take on an entomological aspect. Nos. 2 and 3, which we have just received from Mr. Hart, refer to a limited series of experiments with *Attacus cynthia* and to the so-called "*Bête rouge*," which is apparently the West Indian name for one of the larval Trombidiums commonly known as Red Bugs, Jiggers, and Harvest Bugs. The species is not determined.

A COMPETITION IN ECONOMIC ENTOMOLOGY.

That very active organization, the Trinidad Field Naturalists' Club, has just instituted a competition in economic entomology, the prizes to be $30 and $20. The prizes are to be given for the best and second best essay on economic entomology, each essay to be accompanied by collections containing all of the insects mentioned, and essays and collections to be the property of the Club and to treat only of Trinidad pests.

GRAIN INSECTS IN SUGAR.

From Mr. Thomas Nixon, of Zyba, Kans., we have received the larva of *Tenebrioides mauritanicus* L. found in sugar. Its presence there was purely accidental, as the larva is undoubtedly predaceous, feeding upon the immature stages of other insects that live in stored grain and similar substances.

On a previous page of the present number, at No. 23 in the list of insects found at the Columbian Exposition, we have referred to this species. In several closed jars of sugar at the Exposition we noticed living specimens of the Rice Weevil (*Calandra oryzæ*) and one or two other species, but attached no importance to the matter as their occurrence there was doubtless due to the fact that the receptacle containing the sugar had been left standing open in the vicinity of other receptacles containing grain, flour, or other farinaceous products. No insects are known to breed in refined sugar, but some of the mites of the genus Glyciphagus, called sugar mites, infest the cheaper grades of brown sugar and the sugar of dried figs, prunes, and other fruits. The commoner species of insects that infest flour and meal, dried fruits, and the like in warehouses and groceries, such as *Plodia interpunctella* and *Silvanus surinamensis*, are often sent to us with the statement that they were found in sugar, salt and other substances that could not serve as their food. Perhaps the most remarkable case of this sort that has come to our notice is that published in Volume I of INSECT LIFE (p. 314) concerning this same *Tenebrioides mauritanicus*, which was found to have lived for some time in the insecticide, white hellebore.

EXTRAORDINARY MULTIPLICATION OF CERTAIN LEPIDOPTERA.

At a meeting of the Entomological Society of France, held October 28, M. C. Jourdheuille called attention to the wonderful multiplication of *Lasiocampa pini* L. in the valley of the Seine, where its presence had been noticed only within the last few years. It attacked not only older trees but also the young scions, involving in some cases the destruction of these last. He exhibited a twig of *Pinus sylvestris* plucked at random upon which fourteen larvæ had spun up, pressed close to one another.

The same member showed leaves of *Populus nigra* upon which were traces of thirty or forty *Lithocolletis populifoliella* Tr., an insect which has multiplied prodigiously in the valleys of the Seine and Aube. To give an idea of its inconceivable abundance, M. Jourdheuille cited two authentic instances. At Viapres on the Aube one of his friends, returning to his country house, went to light the fire when a squirming mass of these little insects, as large as his head, fell upon and extinguished the fire. Upon another occasion, returning home at twilight, he was compelled to stop, as was his horse, blinded by the swarms of the same insect, which flew into the eyes, nose, and ears of the horse and its driver, and prevented their advance.

THE POTATO-TUBER MOTH IN CALIFORNIA AND TEXAS.

The California *Orchard and Farm*, in its issue of September 15, 1893, commenting upon our editorial in Vol. v, p. 291, entitled "Legislation against Insects," states that the U. S. Division of Entomology is about

thirty years behind the common knowledge in California on the Potato-worm question. He goes on to say that potato growers have had the Tuber-worm to contend with as far back as 1856. The only specific proof of the statement as to the "common knowledge" referred to which is given is that in October, 1892, the editor, in company with Prof. C. H. Dwinelle, secured specimens of infested potatoes from J. P. Thomas, a commission merchant of San Francisco, who had known the pest for twenty-five years. We must confess that Mr. Thomas' statement is probably to be relied upon, as we know of no other insect which possesses this same habit and which could by anyone be mistaken for this species. The joke, however, can hardly be said to focus on the Division, for neither potato growers nor dealers in California seem to have been aware of the facts mentioned by the *Orchard and Farm*, and we know of no previous published records than those we have called attention to. This Division has been in active correspondence with Californians for nearly fifteen years, and no one ever sent us specimens of this insect until 1891. Two agents of the Division of Entomology have been stationed in California for seven years, and no person interested ever brought this insect to the attention of either. Through its State Horticultural Society and its State Board of Horticulture, California has been publishing matter concerning injurious insects for fourteen years, and yet no mention of this insect has ever been made in any of the reports of these organizations. A large and comprehensive work on the injurious insects of California was published in 1882 by Matthew Cooke, who for some years had been officially connected with one of the State organizations in an entomological capacity, and in this book no hint is given as to the existence of such an insect. If the persons interested in the suppression of an insect pest do not take the trouble to bring it to the attention of economic entomologists, the latter are hardly to be blamed if they remain in comparative ignorance of its existence, when, as in our case, there was no chance for personal observation.

A letter received late in September from Mr. Fritz Grasso, Baron Springs, Fredericksburg, Tex., stated that the Potato-tuber Worm was very abundant in his potato patch last year. Mr. Grasso stated that nearly every potato dug up in his patch was infested. In 1891–'92 it was present, but by no means as abundant. In the month of July the moth was noticed on the housed potatoes in "dense swarms." We have not learned from Mr. Grasso, up to the recent time, any facts as to first appearance, point of introduction, and distribution of the insect in Texas, but hope to obtain reliable information upon these points.

HYMENOPTERA FROM LOWER CALIFORNIA.

The Hymenoptera of the peninsula of Lower California have hitherto been but slightly known. Mr. Gustav Eisen, of the California Academy of Sciences, and Mr. Chas. D. Haines have collected a number of

species in this order, which have been determined by Mr. William J. Fox, of Philadelphia, and Mr. Theo. Pergande, of Washington, the latter reporting upon the ants and the former upon the other members of the order. Their papers are published in the proceedings of the California Academy of Sciences, Vol. IV, second series, and reprints have been received from both authors.

ANTS AND THE FRUIT-GROWER.

Items concerning the offices of ants in the orchard and garden are constantly being published in the horticultural and agricultural press, and the most diverse opinions are expressed. We happened among our recent newspaper clippings to find two absolutely contradictory statements, the one entitled "Ants a Help to Fruitgrowing," in which the author states that ants are of the most valuable assistance to the farmer by acting as perpetual insect destroyers, the other referring to damage done in vegetable gardens in the way of eating lettuce seed and other small seeds, and "sucking the life out of acres of young cucumbers and melon plants." The truth of the matter is that, on the whole, ants do more harm than good. It is true that they destroy a certain number of injurious insects, but they likewise carry off small seed, and frequently ruin lawns and flower beds. The principal damage which they do, however, aside from their work as household pests, is in their care of injurious plant-lice and bark-lice, and in their great assistance in spreading these insects. They are probably responsible for the greater part of the damage done by several species of plant-lice. It has been recently proved, for example, that the common Corn-root Plant-louse would have difficulty in hibernating if it were not for the fact that its eggs are carried into the nests of the little brown *Lasius alienus*, and there cared for during the winter.

CANADIAN SAW-FLIES.

Under the title "Fauna Ottawaensis, Hymenoptera Phytophaga," Mr. W. Hague Harrington published in the *Ottawa Naturalist* for November, 1893, an important list of the saw-flies and horn-tails which he has collected in and around Ottawa. The list comprises 166 species, and indications are given of date of capture, and a few other notes as to food habits are scattered through the list.

CHILEAN ODYNERIDÆ.

Mr. Edwyn C. Reed has just published in the Anales de la Universidad, a paper entitled "Synopsis of the Chilean Wasps of the Family Odyneridæ," forming a portion of a series which he intends to call "Chilean Entomology." The paper consists mainly of a bringing together in synoptical form of the species heretofore described by other authors, and three new species are characterized.

LOWNES'S MONOGRAPH OF THE BLOW FLY.

The fourth part of Mr. B. T. Lownes's very elaborate monograph on the Anatomy, Physiology, Morphology and Development of the Blow Fly (*Calliphora erythrocephala*) has been recently received. If we understand the author's intention, the first three parts are to constitute Vol. I, and the fourth, with one or more parts yet to be published, Vol. II, of the Monograph. The first volume deals with the subject generally, with the anatomy of the larva, the development of the embryo in the egg, and of the nymph in the puparium, as well as with the external skeleton of the perfect insect. The second volume deals with the various internal organs, their development and physiology, and part 4, the first part of this volume, treats of the tracheal system, the alimentary canal, and the nervous system. The author, in connection with the various chapters, gives résumés of the principles of anatomy, morphology, and histology as applying to insects in general, as a sort of introduction to the specific consideration of the form studied. With each of the four parts so far issued is given a short appendix, with useful details of the methods of study followed by the author, including directions for the preparation and mounting of the tissues for microscopic study. Scattered throughout the publication is also a very extensive bibliography which the author intends shall ultimately include all of the works on the subject which he has consulted, or all which possess historic interest and contain original work. The extent of the monograph may be gathered from the fact that it has already reached nearly 500 pages, with 33 plates and 61 text figures. The illustrations are reproduced directly from the drawings of the author, and while not as finished as might be wished, are sufficiently well made to convey the information intended. It is a well-printed work, and will be a very valuable addition to our knowledge of the morphology and physiology of insects.

HIBERNATION OF THE ORANGE FRUIT FLY.

Mr. S. D. Bairstow, in the *Agricultural Journal*, of the Cape of Good Hope, for November 2, 1893, states that he has shown by breeding-cage experiments that *Ceratitis citriperda* hibernates in the adult condition under dead leaves and other débris, the flies disappearing into hibernating quarters during April and emerging in October and later.

FOR PLANT-LICE IN GREENHOUSES.

Col. Wright Rives, of Rives Station, Md., has for some time past obtained most excellent results in his extensive greenhouses in fumigating with tobacco smoke against the "green fly" (plant-lice in general). Most methods of fumigation result in some danger to the plants on account of the "heat" of the smoke. Col. Rives fills a flower-pot with tobacco dust, packs it in firmly, and inverts it, leaving the dust in

the form of a truncate cone. He then sticks his finger into the apex of the cone, making a hole half an inch in depth, into which he pours half a teaspoonful of kerosene. He leaves it a few minutes and then lights it with a match. The resulting smoke is dense and cool and the cone burns down to the ground.

AUSTRALIAN PARASITES OF VERTEBRATES.

Apropos to the description of a new flea from New South Wales, Mr. F. A. A. Skuse, in the Records of the Australian Museum, Vol. II, No. 5, gives a list of the insect parasites of Vertebrates which he knows to occur in Australia. The new flea occurs on the body of the Australian Tiger-cat, and for it Mr. Skuse erects the new genus Stephanocircus, characterized chiefly by the absence of eyes in the female and the possession of an exerted cap-like patella in the front of the head. Among the animal parasites he mentions the common Sheep and Horse Bots, two species of the Oscinid genus Batrachomyia, the larvæ of which live under the skin of frogs, two species of Hippobosca, five of Ornithomyia, the common Sheep Tick, a single species of Olfersia, five fleas of the genus Pulex, one of the genus Echidnophaga, occurring upon the Australian Porcupine, the common Bed Bug, the head, body and crab Lice, and of other lice two species of Philopterus on chickens and pigeons and five of Trichodectes on domestic animals. Most of the latter are of wide distribution and by no means confined to Australia.

KEROSENE EMULSION AGAINST SHEEP TICKS.

A recent writer in the *American Agriculturalist* speaks highly of kerosene emulsion for killing sheep ticks. He has tried a score or more of remedies and finds that this has the advantage of cheapness, ease of application, harmlessness to the animal, and efficiency against the ticks. Instead of dipping the animals, which the average sheep raiser considers altogether too much trouble, he crowds the sheep into some corner or pen, so as to bring them into a compact body, and then sprays the emulsion over them until they are thoroughly wet, the flock being occasionally moved about so as to expose all parts of the body. We are glad to see this practical testimony, since, although the effectiveness of the remedy was proved some years ago by Messrs. C. P. Gillette and Cooper Curtice, the late tendency of Experiment Station entomologists has been to depreciate the use of the emulsion on account, as they say, of the difficulty which the ordinary individual has in making a perfect emulsion. As we have stated on two occasions before the Association of Economic Entomologists, we do not consider this a valid reason for refraining from recommending an efficient remedy. The farmer must be induced to take a little pains in this matter. He must be shown that it is not difficult when properly undertaken and he must, in fact, be educated up to its use.

THE ORTHOPTERA OF THE GALAPAGOS ISLANDS.

We have received from Mr. S. H. Scudder a paper with the above title extracted from Vol. xxv of the Bulletins of the Museum of Comparative Zoology, Harvard College. The author reviews all previous accounts of Orthoptera from these Islands and reports the results of his own examination of material recently collected by the Fish Commission Expeditions. Specimens of all but one of the species ever reported have been examined. Excluding the Cockroaches, but fifteen species have been found upon these Islands and all are distinctly South and Central American in their affinities, five being apterous or subapterous forms. This large proportion of forms incapable of flight is accounted for in Mr. Scudder's mind by the supposition that the Galapagos are of very recent origin and have obtained their present Orthopterous fauna by chance advent of pregnant females as waifs from the nearest shore or the shore which the currents of the ocean make practically the nearest. The paper includes the description of a new species of Earwig, a new genus and two new species of Mantidæ, three new genera and three new species of Acridiidæ, one new genus and two new species of Locustidæ and one new species of Gryllidæ. The new forms are illustrated upon three well-executed lithographic plates.

OBITUARY.

Dr. Herman August Hagen, professor of entomology in Harvard University and curator of the insect collection of the Museum of Comparative Zoology at Cambridge, died November 9, at the age of 76. Dr. Hagan was a well-known German entomologist residing in Königsberg, when, in 1868, he was invited by Louis Agassiz to come to Cambridge as assistant in entomology. His residence in this country has since that time been continuous. He was probably the most learned student of the Neuroptera that the world has seen, but was also a general entomologist of wide attainments. His familiarity with the literature of entomology was extraordinary, and his Bibliotheca Entomologica, published in 1866, has always been the first requisite on the working table of entomologists of all countries. A long and painful illness had incapacitated Dr. Hagen from work for the past two years, and the duties of the position have of late been performed by Mr. Samuel Henshaw, who we hope will permanently succeed to the position, as he is in every way competent to fill it.

We have also to record the death of Mr. Wilhelm Juelich, at his home in New York City, November 8, 1893, at the age of 54. Mr. Juelich was a native of Germany, but came to this country in his boyhood. He began the collection of Coleoptera before the War, and at the time of his decease his cabinet was one of the largest in this order in this country. It was particularly rich in the Rhynchophora and in several families of micro-coleoptera. He was a member of the entomo-

logical societies of New York, Brooklyn, Newark, Philadelphia, and Washington, and had published a number of interesting articles on his favorite topic in *Entomologica Americana* and other periodicals. He was widely known as an enthusiastic collector, and in the earlier work of Drs. LeConte and Horn, and in the later work of Capt. Casey, contributed much assistance in the donation and loan of material for description and study.

ENTOMOLOGICAL SOCIETY OF WASHINGTON.

December 7, 1893.—Mr. G. B. Sudworth was elected an active member. Mr. R. H. Wolcott, Grand Rapids, Mich., was elected a corresponding member. The election of officers for 1894 resulted as follow: President, William H. Ashmead; vice-presidents, Theodore Gill and C. L. Marlatt; recording secretary, L. O. Howard; corresponding secretary, F. H. Chittenden; treasurer, E. A. Schwarz; additional members executive committee, George Marx, B. E. Fernow, and C. V. Riley.

Mr. Marlatt read a paper entitled "Revision of the genus Pontania, Costa, with Descriptions of New Species." This genus is an off-shoot of the old genus Nematus, containing the small species of gall making habits. Seventeen species belonging to the North American fauna were described. Discussed by Prof. Riley.

Mr. Chittenden presented by title a paper on the habits of some Coleoptera, which was referred to the publication committee.

Mr. Howard presented a "Note on the mouth-parts of Stenopelmatus," describing the trophi of this genus and calling attention to an abnormal asymmetry in the galeæ.

Mr. Fernow spoke in regard to "antinonnin," a new insecticide recently introduced into this country. Discussed by Messrs. Riley, Waite, and Swingle.

Two short notes by Mr. A. D. Hopkins were read by the Secretary, the first describing a new Scolytid—*Corthylus columbianus* which affects oak timber. The second note was on the food-habits of *C. punctatissimus*, which was found to breed in small bushes of Dogwood, Hazel, Sassafras, Water Beech, Sugar Maple, and Ironwood.

Mr. Heidemann exhibited a series of Capsids allied to *Lygæus turcicus*, all of which he considered as varieties although several of them have received specific names.

Mr. Ashmead exhibited a Chalcidid which he considered as identical with Fabricius's *Chalcis cyaneus*, and stated that the species belongs to *Chryseida* Spinola. He also stated that this genus belongs to the Eurytominæ instead of to the Perilampinæ, in which it is placed by Westwood.

C. L. Marlatt,
Recording Secretary.

January 11, 1894.—A letter from Mr. A. D. Hopkins, of Morgantown, W. Va., was read by the Secretary, announcing the discovery of a Tulip tree more than 400 years of age, in which the work of *Corthylus columbianus* Hopkins mss., dating back to pre-Columbian times, has been found.

The resignation of Mr. F. H. Chittenden as corresponding secretary was accepted and Frank Benton was elected to fill the vacancy.

The annual address of the retiring president, Prof. C. V. Riley, was then delivered. The title was "Natural Selection as applied to Longevity in Insects." The treatment of the subject comprised an extensive review of the length of life of the different stages of insects of all orders, including an elaborate history of the larval life of *Cicada septendecim*, introducing many new facts, and describing in detail the larval stages. He felt that Weismann had made a mistake in considering only the longevity of the adult in insects and showed that it was very generally true that

the term of larval life is prolonged proportionately to its diminution in the adult, and *vice versa*. While dissenting thus in some minor particulars from Weismann's views, he, nevertheless, believes that this author has made out a clear case that the length of life in animals has been very largely regulated by the necessities and conditions of life and chiefly through natural selection. The conclusions drawn from other animals are particularly justified when insects are considered, the numerous cases particularly of retarded development under exceptional conditions indicating the great elasticity possessed in this particular by insects upon which natural selection could play. Discussed by Messrs. Fernow, Schwarz, and Ashmead.

February 1, 1894.—Mr. H. G. Hubbard read a paper on the "Oviposition of *Melitara prodenialis* Walk.," a Phycid moth whose larvæ bore into the pads of different species of Opuntia in Florida, and the eggs of which are laid in a long stick or chain. Discussed by Messrs. Howard, Gill, Schwarz, Riley, Ashmead, and Stiles.

The Corresponding Secretary read a letter from Mr. T. D. A. Cockerell upon the "Hymenoptera of Jamaica," in which all of the species observed by the writer were listed and the character of the fauna was compared with that of North America and the other West Indian Islands. Discussed by Messrs. Hubbard, Schwarz, Riley, Ashmead, Howard, and Gill.

Mr. Schwarz read a communication entitled "Notes on Melsheimer's Catalogue of Coleoptera published in 1806," exhibiting a copy of the catalogue which had been in the possession of Melsheimer and his two sons and which had been annotated in manuscript by J. F. Melsheimer. Mr. Schwarz commented at some length upon the footnotes given by Melsheimer to some species, mostly of economic interest. Discussed by Messrs. Riley and Waite.

Under the head of Exhibition of Specimens and Short Notes Dr. Marx exhibited an enlarged figure of a remarkable spider of the family Oonopidae which differed from all known forms in having a sclerite between the coxa and the sternum. Discussed by Messrs. Schwarz, Gill, Riley, and Ashmead. The secretary exhibited two figures sent in by Mr. Hopkins and which indicated the holes and stains made by *Corthylus columbianus* in the tree mentioned at the preceding meeting. Mr. Ashmead exhibited specimens of *Eudoxinna transversa* Walk., and a new genus of the Proctotrypid subfamily Diaprinne which he proposes to call Notoxoides. Mr. Hubbard exhibited specimens of *Doryphora decemlineata* collected at Fort Assiniboine, Mont., and which had not come in contact with the cultivated potato.

L. O. HOWARD,
Recording Secretary.

U. S. DEPARTMENT OF AGRICULTURE.

DIVISION OF ENTOMOLOGY.

PERIODICAL BULLETIN. Issued May, 1894.

Vol. VI. No. 4.

INSECT LIFE.

DEVOTED TO THE ECONOMY AND LIFE-HABITS OF INSECTS, ESPECIALLY IN THEIR RELATIONS TO AGRICULTURE.

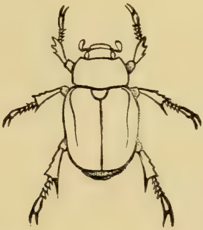
EDITED BY

C. V. RILEY, Entomologist,

AND

L. O. HOWARD, First Assistant,

WITH THE ASSISTANCE OF OTHER MEMBERS OF THE DIVISIONAL FORCE.



[PUBLISHED BY AUTHORITY OF THE SECRETARY OF AGRICULTURE.]

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1894.

CONTENTS.

SPECIAL NOTES.

Eighth and Ninth Reports of the New York State Entomologist.—We have just received from Dr. J. A. Lintner copies of his long-delayed eighth and ninth reports as State Entomologist of New York, the eighth report covering the year 1891 and the ninth 1892. They are extracted, respectively, from the forty-fifth and forty-sixth reports of the New York State Museum and are published with both paper and cloth bindings. Both reports show Dr. Lintner's usual great care and attention to detail, and his bibliographical lists of the most prominent insects treated not only indicate his great familiarity with the literature of economic entomology, but afford the greatest service to the working entomologist. The paper, type, and printing are all good, and each report, as in previous years, contains much interesting matter in appendix form, including reprints of the addresses delivered by Dr. Lintner during the year, and a complete summarized list of his publications. The ninth report contains, in addition, a reprint of Dr. Fitch's rare catalogue of the Homoptera of New York, with critical remarks upon the synonymy of the species, including corrections and notes, by E. P. Van Duzee and C. V. Riley. The principal insects treated in the eighth report are, the Raspberry Geometer (*Synchlora glaucaria*); the Birch-leaf Bucculatrix (*Bucculatrix canadensisella*); the Pear Midge (*Diplosis pyrivora*); two Frog-hoppers (*Clastoptera obtusa* and *C. pini*); the Comb-horned Fish-fly (*Chauliodes pectinicornis*); the Horned Corydalus *Corydalus cornutus*); the Lunated Long-sting (*Thalessa lunator*); the Currant Stem-girdler (*Janus flaviventris*); the Larch Saw-fly (*Nematus erichsonii*); and a number of other insects which receive briefer treatment. Those treated in the ninth report are, two Carpet Beetles (*Anthrenus scrophulariæ* and *Attagenus piceus*); the American Meal-worm (*Tenebrio obscurus*); the Cluster Fly (*Pollenia rudis*); the Pear-tree Psylla (*Psylla pyricola*); and the Green-striped Locust (*Chortophaga viridifasciata*).

Report of the Official Entomologist of the Dominion of Canada.—Mr. James Fletcher sends us the author's edition of his report as Entomologist and Botanist to the Central Experiment Farms at Ottawa, and in the entomological portion he gives excellent articles upon Cut Worms, the Red-legged Locust, granary insects, and a number of less important species which he treats under the respective heads of species injurious to root crops, fodder crops, vegetables, fruits, forest trees, and live-stock. The report contains a number of interesting notes, one of the most important of which refers to the Black Vine-weevil (*Otiorhynchus sulcatus*), a beetle common to Europe and North America, and which, in Europe, does considerable damage to the vine. Mr. Fletcher has received specimens from Victoria, B. C., which were feeding on the roots of Cyclamens in greenhouses. The species now occurs in British Columbia and Nova Scotia, as well as the New England States. Its occurrence in the East is supposed to be from accidental introduction, and it may equally as well have been introduced at Victoria, although Mr. Schwarz is inclined to think that it is native to North America and a member of the circumpolar fauna. The Horn Fly has increased enormously and spread rapidly throughout the provinces of Ontario and Quebec, and in some districts the milk supply was reduced one-half. Mr. Fletcher finds that when the flies are at their worst it is necessary to spray cattle with ordinary kerosene emulsion every two days. Tanner's oil, however, containing some carbolized oil, or oil of tar, is more lasting in its effects, but takes longer to apply and requires much greater labor.

Miss Ormerod's S venteenth Report.—The somewhat anomalous annual report published by Miss Ormerod upon the injurious insects and common farm pests of England, for the year 1893, has just reached us. We call this report anomalous for the reason that, as we have previously mentioned in these pages, Miss Ormerod's work is gratuitous and her report is published at her own expense. She has devoted her labors to the good of the agricultural classes of England in the most philanthropic and praiseworthy manner. She stands almost alone in economic entomological work in England. Her report for 1893 fully sustains the generally excellent character of the series, and while few of the insects treated occur on this side, several of them have their vicarious forms with us, and the report is therefore, of much interest to American workers. One of the most interesting articles in the report is that upon wasps, in which Miss Ormerod treats at length of the extraordinary abundance of species of the genus Vespa, not only in England but in other parts of Europe during the season of 1893. This abundance was productive of much more harm than good, for while the species kill other insects, they inflict, when excessively abundant, a great amount of injury in the way of loss to fruit-growers and much

inconvenience and pain by their attacks upon men and horses in the field, as well as by their extraordinary infestation of houses. The reason for this extraordinary abundance of Vespidæ is supposed by Miss Ormerod to be the long-continued dry weather of the spring. It seems there were not the "usual intervals of cold and wet to catch and destroy the queen wasps, when warmed into active life and drawn out from their winter shelters by what in most years is an alternation of sunshine with weather that leaves the houseless queens between whiles exposed to just the conditions unfavorable to their own existence and likewise to that of their embryo nests."

Monograph of the Phycitinæ and Galleriinæ.—A very important work on these two sub-families of the Pyralidæ has recently come to us through the courtesy of its author, M. E. L. Ragonot, of Paris. It is published at St. Petersburg as Part VII of the *Mémoires sur les Lépidoptères* issued under the auspices of the Grand Duke Nicolas Mikhailovitch. The history of the preparation of the monograph is given in the preface, and in a long introduction a full discussion of the sub-families and of the generic characteristics is given. This introduction, with its synoptic tables, will prove invaluable to all students of the groups. The balance of the monograph, some 658 pages, is taken up with full descriptions of the species, the generic diagnosis accompanying the consideration of each genus. There are 23 chromo-lithographic plates, admirably executed, with sufficient detail of structure to make them extremely valuable for identifying species. The first three are devoted entirely to structural details, while the balance are colored figures. These are arranged very tastefully, and by giving only the body and one pair of wings, a great many figures are crowded on each plate, while at the same time a certain harmony of arrangement has been maintained by the wings on either half of the plate opposing each other.

One of us has followed M. Ragonot's work for many years now, having had a pleasant personal intercourse and correspondence with him. We know how faithfully and diligently he has worked, and of late years under many difficulties of poor health and confinement; and we congratulate him and Lepidopterists generally upon the final issue of his efforts. Such monographs as these give dignity to and advance the science of Lepidopterology. We regret that the fashion has been followed of printing specific names in capitals, and although the author has done this to conform to the preceding volumes of the *Mémoires*, he nevertheless inclines to defend it, though he would have preferred confining the capital letter to proper names. He fails to see the utility of uniformly dropping the capital letter for specific names, and gives as the chief reason for opposing this custom, which is spreading, that it becomes impossible to recognize those species, of which the names

should recall those of well-known entomologists, or serve to honor the names of the originators. This remark indicates how prevalent yet the idea seems to be that natural history names are for the purpose of honoring those who coin them, or those for whom they are coined, rather than of advancing knowledge.

The San José Scale in the East.—When we announced, at the meeting of the American Association for the Advancement of Science last summer, that the San José Scale (*Aspidiotus perniciosus*) had been found in the vicinity of Charlottesville, Va., we were not aware that this species had obtained a foothold at other points in the East; but during the month of March of the present year specimens of this insect were received from De Funiak Springs, Fla., and from Charles County, Md., with reports indicating that very considerable damage had already been done in both localities. In April it was received from Lewisburg, Pa., but is apparently limited to a few pear trees and one apple tree. Since the publication of the last number of INSECT LIFE, in which reports from Messrs. D. W. Coquillett and E. A. Schwarz were printed, the Division has, with the aid of the Virginia State Board of Agriculture, conducted fumigating operations at Charlottesville, which we hope have stamped out the insect in that locality. A report on these operations is given in this number. Careful study is now being made of the occurrences in Florida and Maryland, and in the latter case, on account of its proximity to Washington, the insect will be most carefully watched, and exterminated if possible.

The almost simultaneous appearance of the insects in great numbers in these three widely separated localities indicates that there is every probability that it exists at present in other—perhaps many other—eastern orchards. In Virginia and Maryland the insect was undoubtedly introduced upon nursery stock purchased from eastern nurserymen. More of this same stock must have been sent out at about the same time. In view of this strong probability notices have been sent to all the agricultural newspapers describing the scale and urging fruit-growers to examine their orchards carefully and report to the Department. An emergency bulletin, condensed from the forthcoming annual report of the Entomologist, and giving a complete account of the insect and the best remedies to be used against it, has been prepared and is ready for distribution to all applicants. It is too early to predict the consequences of the appearance of this extremely destructive species on the Atlantic coast, but the Department will do all it can to aid those concerned in stamping it out, as it has done at Charlottsville.

A NEW AND DESTRUCTIVE PEACH-TREE SCALE.

(*Diaspis lanatus* Morg. and Ckll.)

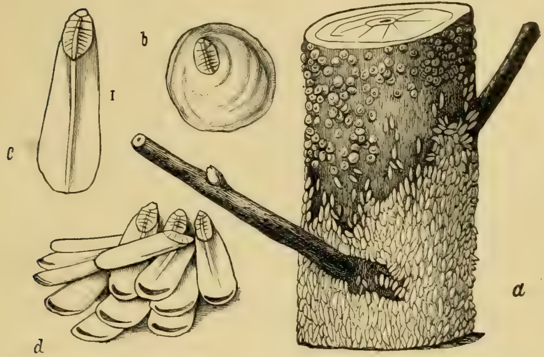


FIG. 12.—*Diaspis lanatus: a*, section of peach trunk with male and female scales *in situ*—natural size; *b*, scale of adult female; *c*, do. male; *d*, do. in natural position—enlarged (original).

An interesting and destructive bark-louse has recently made its appearance in certain portions of the Atlantic States. Its life-history has been carefully investigated during the past year, and some account of the species has been prepared for the Annual Report of the Department for 1893, now in the printer's hands. The more technical portions of the investigation, including the full and detailed descriptions of the different stages of the insect, were necessarily omitted from this report, however, and on account of their scientific importance we introduce them here.

DISCOVERY, OCCURRENCES, AND LIFE-HISTORY OF THE SPECIES.

In regard to the discovery and occurrences of the species, and its previous history, we may briefly summarize for the purposes of this article, as follows:

Certain seedling peaches, growing in rows on the grounds of the U. S. Department of Agriculture, were found in 1892 to be badly affected by a scale-insect which was recognized as new to the fauna of the United States. The young trees were badly damaged, and the lower halves of the trunks of many of them were covered with the scale-insects, which were present in extraordinary numbers, giving the worst-infested trees the appearance of Fig. 12. The young twigs of these trees were already dead and dry. The species was found to be identi-

cal with *Diaspis lanatus* Morg. and Ckll., first described in the *Journal of the Institute of Jamaica.* *

In Jamaica, according to Mr. Cockerell and his successor, Mr. Townsend, the insect occurs upon Grape, Bastard Cedar (*Guazuma ulmifolia*) *Cycas media*, Capsicum, *Argyreia speciosa*, the bark and twigs of an undetermined malvaceous plant, *Bryophyllum calycinum*, Peach, Pelargonium, Jasminum, stems of Cotton, *Calotropis procera* (French Cotton) and *Hibiscus esculentus.* In Trinidad it occurs upon *Carica papaya*, according to the observations of Mr. F. W. Urich. Acanthus, Peach, and Sedum are added by Mr. Townsend in the last number of the Journal of the Institute of Jamaica (Vol. I, No. 8), and the Entomologist found the species excessively abundant on several of the above-mentioned plants during his recent trip to the West Indies. Two of the oldest Cycads (*Cycas circinalis*) in the once celebrated but now much neglected botanical garden at St. Pierre, Martinique, were seriously affected, the bracts being white with the male scales and entirely killed. It was also bad on *Zamia mexicana*, upon which the director, M. Eugene Nolet, thinks it was introduced to the garden.

In this country it was received in September, 1893, from Mr. S. F. Harvey, of Molino, Fla., and in October of the same year from Mrs. E. Johnson, of Bainbridge, Ga. The origin of the Washington specimens above referred to has not been ascertained, although every effort was made to learn the source from which they came. The rows of young trees were started by assistants in the Division of Vegetable Pathology, for the purpose of inoculation with Peach Yellows and other diseases of the Peach, which that Division was engaged in studying. The trees were raised from seed, and in consequence most careful search was

---

* The question as to the proper authority for the name of the insect is an interesting one. Mr. Cockerell gave the species the manuscript name of *Diaspis lanatus* and drew up figures and descriptive notes He sent specimens to Mr. A. C. F. Morgan, a well known English writer on Coccidæ, at present located at Oporto, Portugal, who, in his reply, sent Mr. Cockerell a full manuscript description of the species. Mr. Cockerell preferred this description to his own, and wrote to Mr. Morgan proposing that, as he was using the latter's description of the species, it should be credited to Morgan and Cockerell. Mr. Morgan replied that he preferred not to be cited as the authority unless he published the species in a paper of his own. However, Mr. Cockerell published Mr. Morgan's description in the *Journal of the Institute of Jamaica*, as above cited, heading it simply "*Diaspis lanatus* n. sp.," in an article treating of Coccidæ of which he was himself the author, but stating that this description had been sent to him by Mr. Morgan. In the course of the description Mr. Cockerell inserted certain bracketed descriptive passages of his own, and in deference to Mr. Morgan's desire has since referred to the species in correspondence and in print as *Diaspis lanatus* Cockerell. Dr. David Sharp, in the *Zoological Record* for 1892, refers to the species as *Diaspis lanatus* Morgan, n. sp., probably overlooking the fact that the description contained bracketed passages of Mr. Cockerell's authorship. In the face of this curious complication, it seems best to consider the species as one of dual authorship—*Diaspis lanatus* Morgan & Cockerell. It may seem unnecessary to devote so much attention to a point of such small importance, but as a matter of fact the circumstances are almost unique in descriptive entomology.

made for specimens of the insect upon neighboring trees of other varieties. The entire part of the grounds in the vicinity of the trees was searched without result, and the superintendent of the grounds assures us that no changes have been made in the surrounding vegetation since the peach plantation was started. The only plants in the immediate vicinity are a large evergreen hedge, an Osage orange hedge, some young fig trees, and a few grape vines, in addition to the ordinary couch grass and clover, and a few chenopodiaceous weeds. It is possible that the young larvæ may have been brought from a distance upon the feet of birds or upon winged insects, but it is hardly possible that the species, if occurring in any numbers, should not have been discovered, even a block or more away. Later it was found that although the peaches were all seedlings, a few very small twigs and buds had been brought from Delaware for inoculation purposes by Dr. Erwin F. Smith, and a few more from Still Pond, Md. This introduces the possibility that the insect may have been brought upon these small pieces of Peach, but Dr. Smith is a very keen observer and has paid a great deal of attention to insects, and he assures us that the specimens brought were not affected by this insect. Moreover, he has, he says, a most intimate acquaintance with the orchards from which the twigs and buds were brought, and that the occurrence of the Diaspis in either of these orchards would certainly have attracted his attention. The origin of the infection on the Department grounds is, therefore, still obscure.

A similar attempt was made to ascertain the origin in the cases of Mr. Harvey and Mrs. Johnson, and it was learned from correspondence that in the former case they first made their appearance upon some young trees, Peach and Plum, which he had received from California about February, 1888. They were set out and made good growth that year, but upon looking them over in the fall he discovered some dead wood and even dead branches covered with scales. He cut off the dead wood and washed the trees carefully, as he found the scale upon all parts. During the summers of 1889 and 1890 whenever he found a tree infested, he took it up and burned it. During the winter of 1890–'91 he gave orders to have all the California peach and plum trees cut out. They were set out in a pear orchard, with no other peaches or plums in the immediate neighborhood. Something over one hundred were thus destroyed. In 1892 he found several large two and three-year old peach trees covered with the scale. They were half a mile from the spot where the California trees had stood. In the early part of 1893 he found the insect scattered over the orchard; not on all the trees, but here and there throughout an orchard of two to three thousand trees. In September it had made very considerable progress. Up to June he had no doubt that he had brought the scale from California, but during that month he visited several orchards 80 miles to the east, and found the scale at that point. He was informed that none of

the growers in that vicinity had received any young trees from California. He thinks that the insect prefers the Plum, especially the rapid-growing Japanese plums. They were very abundant upon sprouts putting out from the crowns of three hundred old peach trees which he topped two years before. These sprouts were covered with the scale, while the new tops and the old stumps were free, even when the sprouts had run up into the new top of the stump. All these sprouts were grubbed out.

In Mrs. Johnson's case the statement was made that she found it attacking plum and peach trees in her orchard. Upon further inquiry it was ascertained that about four years since she purchased a small lot of peach and plum trees from a nurseryman in Thomasville, Ga. The following summer she noticed that one of the trees (a Chinese Blood Peach) was badly infested with the scale-insect. Some ineffective attempts at remedial work were made, but the insect gradually covered the tree, and in the summer of 1891 she cut it down and burned it. In the meantime she had enlarged her orchard with trees from nurseries at Augusta and Waycross, and at about the time when she cut down the first peach tree she discovered that a plum tree near by was also affected. Since that time she has endeavored to destroy the scale, but at the time of writing it was present on from 25 to 30 trees. A later letter from Mrs. Johnson states that upon inquiry she had found that one of her acquaintances has had some trouble with this insect, and that this individual purchased the plum tree upon which it was first discovered from the same Thomasville (Ga.) nurseryman from whom Mrs. Johnson thinks she received her original stock.

Other Species on Peach.—Mr. Henry Tryon has found in Queensland a species of Diaspis occurring upon Peach, which he described as *Diaspis amygdali.* He recorded it in his Report on Insects and Fungus Diseases No. 1, as occurring at Brisbane, Queensland, and Sydney, N. S. W., and as doing a very considerable amount of damage. This species has unfortunately been introduced into California, and was found by Mr. D. W. Coquillett in February, 1893, at Los Angeles, upon a dwarf flowering almond recently imported from Japan. Japan, therefore, may be the original home of the species, and it may have been imported from that country into Australia. Signoret, in the Annales de la Société Entomologique de France (1869, p. 437), describes *Diaspis leperii* as occurring upon Peach in Europe. The common Rose Scale (*Diaspis* [*Aulacaspis*] *rosæ*) also occurs sparingly upon other rosaceous plants, including the Pear.

A Dangerous Species.—From the above facts it is evident that the species is a very general feeder, and, as a consequence, much more dangerous than if it had but one or two food-plants, as it will be all the more difficult to stamp it out or prevent its reintroduction. So far, it is true, it is reported upon but one or two food-plants in this country, but we shall no doubt before long hear of it upon many others, unless,

indeed, it can be eradicated from the localities in which it has obtained a foothold. There can be little question that it is a West Indian species, and that it has been brought into this country by some of the southern importers of West Indian and other tropical and sub-tropical plants, and the Thomasville (Ga.) nurseryman above mentioned is open to at least a strong suspicion of the responsibility, whether direct or indirect. The fact that it thrives as far north as the District of Columbia adds to the seriousness of the case and to the great desirability of eradicating the species upon its first appearance in any one locality. It is in the hope of helping to bring about such a consummation that we have given this extended notice with illustrations of the species in this article. Proper measures have been taken to stamp it out at Washington, and the correspondents in Florida and Georgia have been urged to do likewise. Nevertheless it seems to us that it has already obtained such a foothold as to make it highly improbable that it will be eradicated. It multiplies with surprising rapidity, since, as we shall presently see, there are from three to four generations annually at Washington.

Life History.—When the insect was first discovered, in December, 1892, the lower halves of the trunks of the young peach trees were more or less completely covered with male scales, while the female scales mainly occupied the trunk in its upper half. In March the female scales were examined and the eggs were plainly seen within their bodies by transmitted light. By the end of April they were found to be full of eggs which appeared to be perfectly developed, although none had been deposited upon April 24. Upon May 5 oviposition had begun, and upon May 13 the young larvæ were hatching by thousands. At this time experiments were made to ascertain whether these larvæ would settle upon Rose. A potted rose, free of scale, was tied to a badly infested peach tree, but none of the young scales migrated to it, although it was examined for ten days or more. The larvæ developed irregularly, and by May 23 some were already twice as large as others, and all seemed to be covered more or less densely with glistening white threads, while a few had begun to form a delicate scale. By May 26 a few had cast their first skin. By June 15 the females had cast their second skin, while the male scale was fully formed and most of the male larvæ had transformed to the pupa state, a few having already become winged. The next day many males issued. About the end of June oviposition began again, and the females attained full size at the middle of August, egg-laying for the third time beginning at the end of August. Another brood developed at the end of October.

Natural Enemies.—No parasites have as yet been bred from this species, and but one predaceous insect has been seen feeding upon it. Late in the fall of 1893 a number of adult specimens of the Twice-stabbed Ladybird (*Chilocorus bivulnerus*) were seen gnawing into the adult female scales at Washington.

DESCRIPTION.

Scale of Female (Fig. 12, *b*).—Rather more than a millimeter in diameter; considerably convex; grayish white in color; exuvia of larva rather more than half way between center and anterior margin. The whole scale covered with a thin layer of the outer skin of the bark. Exuvia dark orange yellow, brownish along sutures, and frequently with a brown spot in the middle; naked, glossy, smooth.

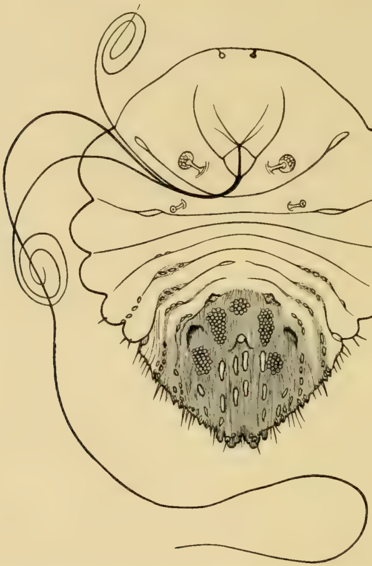


FIG. 13—*Diaspis lanatus:* Adult female, ventral surface—greatly enlarged (original).

Female (Fig. 13).—Color bright orange; shape broad oval, rounded anteriorly and obtusely pointed posteriorly; anal plate brownish; segments of abdomen very distinct throughout their entire length, and, in drying, the lateral margin of abdomen becomes somewhat serrate through indentation of sutures at margin; dorsum with two distinct impressed subdorsal lines and with a quantity of glistening, white, delicate, fibrous, waxy secretion on each side of these subdorsal impressions from fifth segment, leaving the median space and disk of anal plate including pores naked; five rather distinct groups of pores of extremely variable numbers; anterior group composed of 10, 12 to 18 or 20; anterior lateral groups of from 23 to 32, and posterior lateral from 22 to 32; anterior group transversely oval, lateral groups longitudinally oval; those on each side being nearly confluent; four distinct lobes each side of tip of anal plate; median lobes much incised for half their length

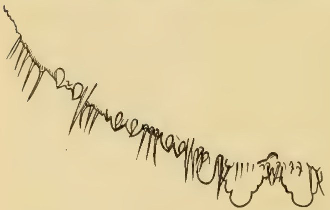


FIG. 14—*Diaspis lanatus:* Fringe of anal plate of adult female—greatly enlarged (original).

with their apical margin somewhat scalloped (see Fig. 14); second pair of plates with inner margin nearly straight, outer margin with two rounded incisions making three rounded sub-lobes; third and fourth lobes acutely dentate, third with one tooth and fourth with three; spines small, rather stout; four lateral spines on eighth segment, five or six on seventh, five or six on sixth, and two each on five and four; in anal plate, on each side exterior to lateral groups of pores (or spinnerets) is a longitudinal row of five narrow, oval, obliquely placed, transparent spots, resembling minute spiracles. Whole surface of body finely, microscopically shagreened.

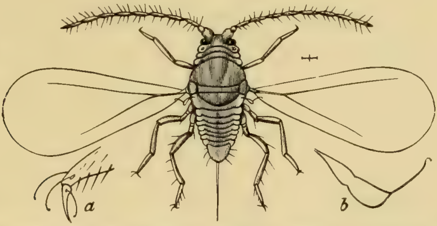


FIG. 15.—*Diaspis lanatus:* Adult male—greatly enlarged; *a*, tarsus; *b*, poiser or balancer—still more enlarged (original).

Scale of Male (Fig. 12, *c*, *d*).—Color pure white. Larval exuvia pale yellow, much lighter in color than that of female. Median carina rather feeble, but extending the whole length of scale. Sides subparallel, slightly diverging in a few specimens. Length rather more than a millimeter; width one-third length.

Male Pupa.—Pale orange in color; eyes purplish black; all limbs white.

Adult Male (Fig. 15).—Length of body, exclusive of style, 0.4 ^{mm}; style 0.2 ^{mm}; expanse 1.2 ^{mm}. General color bright red, sides of abdomen whitish, anal segment yellowish, all legs and antennæ yellowish; eyes dark purple; wings colorless. Antennæ ten-jointed, joints 3 to 10 long, elliptical, subequal in length, scape large, joint 2 very small; legs short, tibiæ a little longer than femora, tarsi about half as long as tibiæ; tarsal claw slender with three digitules. Halteres very slender at base, broadening rapidly to tip of first joint, and somewhat constricted at middle of this joint. Apical or hook joint nearly as long as basal joint. Two ocellar spots on lateral margins of head, immediately behind compound eyes. Thoracic details as shown in figure 15.

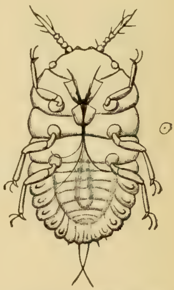


FIG. 16.—*Diaspis lanatus:* Young larva—greatly enlarged (original).

Newly-hatched Larva (Fig. 16).—Color dark orange. Eyes purple, legs and antennæ pale. Antennæ six-jointed. Joints 1 to 5 subequal in length and decreasing in width. Joint 6 long, acuminate, ending in a delicate stylus. Each segment of the abdomen bears on each side a rather strong lateral spine increasing in length towards anal end of body. Two long bristles at tip.

Female Larva, Second Stage (Fig. 17).—Color light orange yellow. Shape very broadly oval. Abdominal segments not incised and difficult to detect. Antennæ not increased in size and appearing almost rudimentary. Lateral bristles very short, scarcely distinguished; anal bristles also short. Surface of dorsum covered with dense, curly, glistening, white waxy threads. The pores from which

the threads are secreted are not evident. Eyes lighter in color than in preceding stage. Surface of skin delicately microscopically shagreened. Legs extremely short. Rostral filaments short.

Other stages not observed.

EXPERIMENTS WITH INSECTICIDES.

A series of careful tests was made with various standard insecticide mixtures to determine the best means of destroying the scales by winter treatment. The first of the series were with the substances which have proved most successful in California in the treatment of the Pernicious Scale (*Aspidiotus perniciosus*), which, in habit and difficulty of treatment, is not unlike this newly-imported one. The lime-sulphur-salt mixture and the winter resin wash were first experimented with, the latter being applied at the strength used in the California experiments, and also at double that strength. The applications were made January 31, 1894, the day being a clear and warm one, and the trees were liberally treated, so that they were thoroughly wetted. The weather continued warm after the applications, and occasional light rains fell. Examination on February 6 showed that so far no injury whatever had resulted to the scales. The rains had not been sufficient to wash from the trees the lime which adhered from the lime-sulphur-salt treatment. On March 7 the lime sulphur-salt treatment still indicated no results in the destruction of the scales. The resin wash at the standard strength had resulted in the death of about 20 per cent of the scales; at double the standard strength, in the death of about 50 per cent. Examined April 2, the ratio of injury in the case of the resin wash applications had not changed. A very few dead scales were found on the trees treated with the lime-sulphur-salt wash—perhaps about 5 per cent.

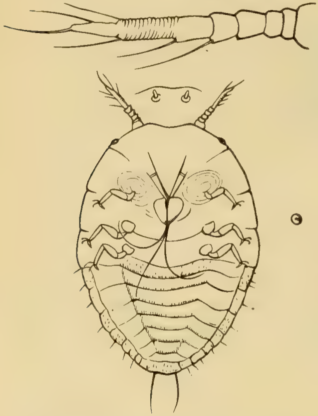


FIG. 17—*Diaspis lanatus:* Half-grown female, enlarged, with frontal tubercles and greatly enlarged antenna above (original).

The later series of experiments on a new lot of trees was made with kerosene mixtures. Kerosene emulsion made with whale-oil soap and diluted five times, the same diluted two and one-half times, and pure kerosene were used. These applications were made March 10, and the trees were again thoroughly wetted with the insecticides. Examination March 15 failed to show any evidence of injury to the scale in the case of the diluted kerosene emulsion. A tree to which pure kerosene

emulsion was applied presented insects which were not certainly dead, but had changed color, assuming a duller tint and losing the normal bright, glistening yellow of the healthy individual. The same effect, but to a much less degree, was noted in the case of the tree to which pure kerosene oil was applied. Examined March 20, no certainly dead insects were noticeable in the treatment with diluted emulsion, but with the pure emulsion all were dead and rapidly drying up and turning black. Upon the tree treated with pure kerosene emulsion the scales were nearly all in the same condition, perhaps 10 er cent. showing evident signs of life. Examined April 2, kerosene emulsion five times diluted did not appear to have killed a single insect. Diluted two and one-half times, 10 per cent. had succumbed; the rest were apparently uninjured. The pure emulsion had resulted in the destruction of every individual; they were all dried up, flattened, and of a black color. Pure kerosene had resulted in a precisely similar outcome. A certain yellowing of the inner bark of the trees in the case of the last two applications would seem to indicate that some injury was done to the tree, although this may have been due to the injury resulting to the tree from the unusual abundance of the scale itself. All the trees treated have bloomed abundantly, and are now (April 10) coming out in leaf; they appear to be nearly as thrifty as untreated trees similarly infested.

It will be seen from the above that this scale is a most difficult one to treat successfully during the dormant winter period; that it withstands with very little injurious effect the treatment with winter washes which have been measurably successful against the San José Scale in California; and that even double strength of the winter resin wash fails in practical results, since at least 50 per cent of the scales were not injured. A very strong application of kerosene emulsion diluted five and two and one-half times, each applied during the growing season, would certainly result in the death of the trees and fail also to kill any large percentage of the scales. The pure kerosene emulsion, which, on account of its thickness, adhered to the bark with considerable persistence, and the pure oil, were the only applications which were at all satisfactory, and it yet remains to be developed whether the trees themselves have been injured by these applications. We can therefore have very little hope of success from winter treatment unless in the way of pure kerosene oil or pure kerosene emulsion, if it should prove that these are not seriously injurious to the trees; and it will undoubtedly be necessary to treat the scale either by a system of extermination, uprooting and burning the trees, or by treatment with summer washes at the time the young hatch and begin crawling about in an unprotected state over the trees. At this period the ordinary ten-times-diluted kerosene emulsion or any of the standard caustic insecticides, summer resin wash, etc., would undoubtedly result in the destruction of the insect.

THE CURRANT STEM-GIRDLER.

(*Phyllœcus* [*Janus*] *flaviventris* Fitch.)

By C. L. Marlatt.

This interesting saw-fly has again been brought to notice in Dr. Lintner's recently issued Eighth Report as New York State Entomologist (pp. 166–168). It will be remembered that Dr. Lintner, in his Fourth Report, described the girdling of the tips of Currant stems by an unknown Hymenopterous insect in the gardens near Albany, N. Y. (4th Report on the Insects of New York, p. 47), and that later (Insect Life, Vol. III, 1891, p. 407) was published, in Extracts from Correspondence, a communication from Mr. E. W. Allis, Adrian, Mich., with which he transmitted for identification an insect reared from Currant bushes affected as described by Dr. Lintner. No difficulty was expe-

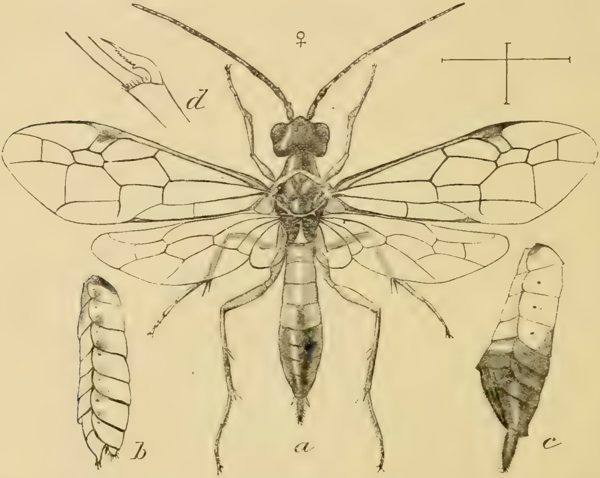


Fig. 18.—*Phyllœcus flaviventris* Fitch: *a*, female; *b*, lateral view of male abdomen; *c*, do. of female; *d*, apex of anterior tibia of female, showing serrated tibial spine—all enlarged (original).

rienced in identifying this insect as a male of Dr. Fitch's *Janus flaviventris*, which he described in his Seventh Report from a captured specimen. In April, 1891, Mr. Allis submitted personally an affected twig of the Currant containing a dried larva, and bred males and females of this insect, donating a specimen of each of the latter to the Department. From these the accompanying illustration was made (Fig. 18). A single specimen was reared by Dr. Lintner, as reported in his last communication, but was mislaid before a careful comparison with Fitch's description was made, but was thought not to be the same

species. This may be readily explained by his probably having a female which differs in shape, size, and coloration very markedly from the male, as will be shown later. The importance of this saw-fly as a serious currant pest warrants the collating of the fragmentary facts in its life-history, as discovered by Dr. Lintner and his correspondents, and by Mr. Allis, and introducing careful descriptions, with figures of both sexes, to facilitate its ready recognition by fruit-growers.

The damage to the Currant, which was first noticed by Prof. C. H. Peck, New York State Botanist, in his garden near Albany, and afterwards by Dr. Lintner in gardens in Albany, was described by Dr. Lintner in his first article as follows:

A short distance below one of the larger leaves of a tip, five or six somewhat sharp curved cuts could be seen encircling the stalk, and from their depth nearly severing it, causing the tip to fall over and hang suspended by only some small point of attachment. In some instances where, from the dried condition of the end of the stalk, it was probable that the cutting had been done a few days previously, the tip had broken off and fallen to the ground.

It was at this time supposed that the egg of the parent insect was deposited in the severed tip, and indeed in a single instance a newly-hatched larva was found very near the point of excision—its occurrence here, as will appear later, being doubtless accidental. Previously, and during the time covered by these observations in New York, Mr. Allis succeeded independently in rearing numbers of both sexes of the parent fly from Currant stems, in his garden near Adrian, Mich. In transmitting his first specimen he wrote:

I send you by this mail one male parent of a native Hymenopterous currant-worm, the same as was noted a year or two ago by Prof. Lintner in his New York report. I first bred one pair in 1887 from larvæ grown in 1886, and this was raised in 1888–'89. The springs of 1888 and 1890 I was not able to find any. Please report name, and so forth.

In conversation at the time of his visit to Washington in 1891, he described the nature of the work substantially as is given in the Eighth New York Report, by a later correspondent of Dr. Lintner, Mr. J. F. Rose, of South Byron, N. Y. Mr. Rose writes under date of June 6, 1891, as follows:

I inclose specimens of a few currant stems which show the work of an insect which cuts them off so that about two or three inches of the young growth breaks over. A few years ago I was badly tormented with currant borers, and on marking several shoots in June that were injured in this way, I found that each of them in the spring had a borer. Since that time it has been my habit to go over the currants several times, cutting off these shoots one inch below the injury and burning the injured tips. I now find very few borers. Am I right in thinking that the saw-fly, or whatever it is that does the cutting, is the egg-inserter that makes the Currant Stalk-borer?

Two of the twigs sent by Mr. Rose were dissected by Dr. Lintner, and the egg was discovered within the stem about one-half an inch below the punctures. It is described as white, transparent, rounded at the ends, one-twentieth of an inch in length and half as broad.

From these records and the knowledge of allied species, I am enabled to present the following summary of the life-round of this insect. The parent fly makes a number of cuts about the twig of the Currant, two or three inches from the tip, girdling it and causing the tip to wither, die, and commonly break off, and deposits a single egg just below the cut. In the exceptional case noted above, of the egg being deposited in the severed portion, we have a case of mistaken instinct on the part of the female, either in depositing the egg above the cut or in cutting below the egg instead of above it, if the egg deposition is the preliminary step. The object of the girdling of the twig becomes apparent from a knowledge of the habits of European species and the other American species whose habits are known, and it is undoubtedly to cause a cessation of growth and the dying and drying condition of wood and pith, which best suits the needs of the developing larva. The young larva works slowly down the center of the twig, feeding on the pith and surrounding woody portion of the stem, becoming full-grown by autumn and spinning a delicate glistening silken cocoon near the base of the burrow in which it winters as larva. The transformation to pupa and adult does not take place until early in May of the ensuing year, the mature insect then cutting its way out by means of its large and powerful mandibles. The specimens which we have from Mr. Allis emerged early in May, and the injury to the tips of twigs indicates that in New York also the adults are flying during this month.

The very simple and easy remedy practiced by Mr. Rose is the best that can be suggested, and with thoroughness in its application will insure immunity from the borer. It will be advisable, however, to cut off the injured shoots at least two inches below the girdle rather than one, as the egg in some instances may have been deposited lower down, or the larva may have hatched and begun its downward course.

The fact that this insect attacks a cultivated plant led to the suspicion that it might be of foreign origin, since it would not be at all difficult to import its larva in currant bushes; but, although there are several closely allied European species having similar habits, none of these come anywhere near *flaviventris* in specific characters. The cultivation of the Currant in south Europe dates back but a few centuries, although it is a native of the north and temperate latitudes of both Europe, Asia and America. It is more than likely, therefore, in view of the abundance of the wild Currant throughout the northern half of this continent, and the absence or nondiscovery of the insect in Europe, that this currant-borer is limited for the present to the North American continent, having in later years transferred its attention from the wild species to the cultivated varieties.

Of the allied European species *P. femoratus* breeds in the lower twigs of the Oak, causing a spindle-shaped enlargement, often exteriorly covered with minute, knob-like elevations, the injured portion

usually slowly dying and drying up. The course of the larval existence is the same as outlined for the currant species, and the perfect insect emerges about the last of April. Another species, *P. compressus*, breeds in pear twigs which wither and die in a manner quite similar to affected currant twigs, the transformations and habits being identical with the currant species. Another species, *P. fumipennis*, affects the Blackberry, a fourth, *P. phtisicus* the Rose, and a fifth, *P. xanthostoma* the Spiræa; while the habits of still other species have not been discovered. These species are mentioned for the reason that any of them, and particularly the last three, are liable to be imported with the plants they infest, and may be either already present in this country or likely to appear at any time.

A closely allied American species, *P. integer* Norton, affects the Willow in exactly the same manner that the currant injury is done, even to the girdling of the twigs to prevent their further growth, the portion beyond the cut drying and eventually dropping off. The girdling is done in the case of this species, and possibly also with the currant insect, by the ovipositor, and is about one inch above the point where the egg is inserted. The female is remarkably similar to the same sex of *flaviventris*, and would, unless carefully examined, be easily mistaken for the latter. It is distinguished, however, by the absence of the sooty spot extending from the stigma, and the first and second abdominal segments usually, and rarely the third in part are yellow. The male of *integer* is easily distinguished by its black or brownish-black abdomen. A full account of this species, with figures is given in volume I of INSECT LIFE (pp. 8–11).

One other American species, *P. trimaculatus* Say, is recorded by Prof. J. B. Smith as infesting the blackberry and raspberry canes. (Rept. Entom. Dept, N. J. Agri. College Expr. Station, 1892, p. 464.)

The subfamily Cephidæ (or tribe *Cephini* Konow) belongs properly to the family Uroceridæ (subfamily *Siricetæ* Konow), which includes the wood-boring Hymenoptera. The Cephidæ have been separated into three genera: Cephus, Phyllœcus and Janus, of which the last is chiefly distinguished from Phyllœcus by a sexual character, viz, whether abdomen is cylindrical or compressed, the former condition being the normal one for the male and the latter for the female. Janus has therefore been generally dropped by later European writers, and in fact both André and Cameron group all the species of Cephidæ together, the former indicating the groups belonging respectively to Cephus and Phyllœcus only in his list of species, describing them all in his monograph under Cephus; and the latter using the three genera merely to group allied species in in the genus Cephus. Konow, however, gives, and rightly in my judgment, full generic value to Phyllœcus. These two genera are separated by the following characters: Cephus, antenna thickened toward the tip; claws with small subapical tooth; Phyllœcus, antenna filiform or tapering toward the tip, claws

forked or cleft at apex. Fitch's single male specimen was quite naturally referred by him to the genus Janus, as formerly understood, and what is unquestionably his veritable type specimen, I was fortunate enough to discover in a badly damaged condition, but still recognizable, among the Tenthredinidæ of the Fitch collection now in the National Museum, enabling me to remove any doubt as to the identity of the species reared by Mr. Allis with *flaviventris*. Since the discovery by Fitch of this specimen, no other examples of this species have come into the hands of entomologists, until the rearings of Mr. Allis, neither Cresson nor Norton having seen the insect. Fitch's description is as follows:

It is a pretty little fly of a shining black color, with the hind body lemon yellow, except at its base, its mouth being straw-colored, and also the hind margin of its collar, the base of its wings, a small spot above their sockets, and the fore and hind margins of the metathorax. The hind body is narrower than the fore body and more narrow and long than in the typical species of this genus, forming almost two-thirds of the total length of the insect. Its basal segment is black, edged anteriorly with straw-yellow, and with a slender line of this color along its middle, ending in a large triangular spot. The second segment is also black, except at its hind end; and on the sides is a blackish cloud on the sutures of each of the remaining segments. The wings are hyaline and glassy, their stigma sooty brown, which color extends inward, occupying most of the anterior marginal cell. A faint smoky cloud may also be perceived near the middle of the posterior apical cell, and another along the margin of the anterior one. The hind feet are dusky.

This species he called the Yellow-bellied Janus, placing it thus, because, as he says, the hind body is cylindrical instead of being compressed.

DESCRIPTION.

I append a more careful description of both sexes, the female being characterized now for the first time.

Female.—Length, 12^{mm}; wing-expanse, 20^{mm}; antennae, 28-jointed; general surface body, glistening; head, large, quadrate, black, palpi and mandibles, yellow, except reddish-brown tip of the latter, which are also very broad and tridentate, the upper tooth longest and middle smallest; thorax black, with hind margin of prothorax, tegulae, spot above base of anterior wings, narrow posterior borders of scutellum and post-scutellum of mesothorax, cenchri, large triangular opening in metathorax, and area beneath the base of posterior wings light lemon-yellow; wing-veins in general brown, costal vein yellow, stigma brown, yellow at either extremity, and with sooty patch extending down over one-half the first cubital cell; tips of wings very faintly infuscated; first cubital cell complete; abdomen, reddish-yellow and black; first segment with small lateral black spot at base, narrowly connected dorsally; second and third segments entirely yellow, fourth with black dorsal spot, balance black, including sheaths; venter of fifth segment somewhat paler; legs in general reddish-yellow, bases of coxae, black; basal one-eighth of tibia lemon-yellow, particularly noticeable in the posterior pair; upper tips of hind femora and outer three-fourths of hind tibiae and all of hind tarsi, dark brown.

Male.—Length, 9^{mm}; wing-expanse 17^{mm}; antennæ 25-jointed; markings and characters in general as in female, except that the legs are much lighter, the anterior pairs being in general pale lemon-yellow throughout, and the hind pair much lighter than in female. The wings are decidedly infuscated at outer margin,

particularly in the lower apical cells. The chief point of difference is in the abdomen, which is generally reddish-yellow; the first segment (second of Fitch's description, the basal plates of the metathorax having been inaccurately described as the first abdominal segment) is black, with yellow apical margin, and a more or less distinct dusky oval spot, growing fainter on the posterior segments, marks the sides of each of the following segments at the base.

HABITS OF STIBADIUM SPUMOSUM *GR.*

By Mary E. Murtfeldt, *Kirkwood, Mo.*

The Russian Sunflower, in which the disk is very large—not infrequently from five to six inches across—and consequently productive of many seeds, is already cultivated to considerable extent in parts of this country, as well as in eastern Europe and Asia, for the value of its seeds as food for horses and poultry. The seeds also yield a well-flavored and delicate oil, of which small quantities are manufactured for commercial purposes, and it is probable that plants of this and allied species will become, in the course of a few years, of considerable enconomic importance.

In view of this fact its insect enemies, of which there are a large number, are worthy of attention. Among these the species named above is prominent. It belongs to a small and peculiar group of Noctuids, of which but three species have been characterized, and, so far as I can learn, the immature stages of these insects have never been studied. A year ago last August I found a large proportion of the heads of the sunflowers infested with some insect which ejected its castings upon the surface of the flower, which, mingled with the withered florets, formed a dry, matted crust that in time became more or less moldy. Upon breaking open the injured disks one or more short, thick, and grub-like lepidopterous larvæ were disclosed. These had been feeding upon the achenia from the under side and forming cavities and channels in the spongy receptacle.

The full grown larvæ were about one inch in length by one-fourth inch in diameter, with very large golden brown head and broad corneous collar of a darker shade of the same color. Otherwise they were of an opaque cream white, in some cases with a slight dorsal rosy suffusion. Specimens sent to Washington were not recognized, and therefore a large number of infested flowers were placed in a rearing cage in the hope that they would complete their transformations so that the species could be ascertained.

When full grown the larvæ dropped from the flowers and burrowed into the earth to the depth of two or three inches, where they inclose themselves in broad, oval, thick, felt-like cocoons, which were outwardly encrusted and disguised with earth. Within these cocoons they soon changed to pupæ, in which form they remained for many

months, as the moths did not appear in the cage until late in August, although out of doors the young larvæ were already at work in the flowers. A specimen of the moth was inclosed to Dr. Riley and by him kindly determined as above.

During the past summer the sunflowers suffered still more than in the previous year, fully seventy-five per cent showing the work of the insect, while about half of those infested had almost every seed eaten. The dwarf varieties of sunflower were also attacked, but the preference of the insect is evidently for the large flowered sorts.

I watched in vain by moonlight and lamplight to see the process of oviposition, as well as to capture some of the moths, but was not able to discover any upon the flowers, and I infer that they are not on the wing until late at night. This conclusion is supported by the fact that among all the various Noctuids taken here at light or by sugaring during the past twenty years there was not a single specimen of this species.

DESCRIPTION.

I append a somewhat more exact description of the larva and pupa:

Young larvæ more slender in proportion than when full grown and usually more roseate in color.

Mature larva 25 ^{mm}. in length, diameter 6 to 7 ^{mm}.; nearly the same throughout; from cylindrical, surface much wrinkled, especially laterally; color opaque cream white with a tinge of rose or pale brown on the medio-dorsal region; piliferous plates pale but distinct, giving rise to short, fine, light hairs. Head golden brown, indistinctly mottled with a darker shade of the same color; trophi almost black with a white base, mandibles unusually strong; cervical collar corneous, polished, mahogany brown, broad and deep, entirely covering the upper surface of the first segment; anal plate small, elliptical, corneous golden brown. Legs brown; prolegs white with brown pads. Stigmata minute but black-rimmed and distinct.

Pupa short, thick with a glassy appearance, of a shaded brown color with tinge of green on thorax and abdomen.

The moth expands about one and one-half inches and the prevailing chocolate-brown color has, as Mr. Grote expresses it, a peculiar frosted appearance owing to the scales being more or less distinctly tipped with white. In the female the ovipositor is noticeably long and telescopic. The affinity of this insect to Gortyna is apparent to the most careless observer.

THE INSECT GUESTS OF THE FLORIDA LAND TORTOISE.

By Henry G. Hubbard, *Crescent City, Fla.*

The Florida Gopher, *Gopherus* (*Xerobates*) *polyphemus*, is a tortoise attaining ten or twelve inches in length and weighing eight or ten pounds. It excavates galleries 18 or 20 feet long in the sandy ridges remote from water. These galleries descend in a straight course at an angle of 35° and terminate abruptly, usually in a layer of indurated

subsoil, at a depth of eight or nine feet beneath the surface. Like its European relative, the gopher is a very long-lived animal. That it may live more than one hundred years I am inclined to believe is true. Certain it is that a quarter of a century brings little or no change to a full-grown tortoise, and the oldest inhabitant in Florida can not tell of the beginnings of some of their burrows. Such ancient and well-established domiciles, with entrances always invitingly open, naturally serve as places of refuge for many animals, when hard pressed by enemies, or to night prowlers when daylight overtakes them far from their proper homes. Even the rattlesnake, according to popular repute, has a more than passing acquaintance with these cool retreats.

A number of years ago I learned that the gopher has for a permanent guest, a sort of parlor boarder as it were, a batrachian, commonly called the gopher toad. Specimens of these I frequently saw on summer evenings sitting at the entrance of the burrows after the manner of toads, quietly waiting for their supper to come to them. On the slightest alarm these timid creatures leaped quickly back into the gopher hole and saved themselves, so that it was not until lately that I succeeded in capturing a specimen, and found to my surprise that the so-called toad was a veritable frog. The herpetologists of the National Museum, to whom I have recently forwarded specimens, pronounce it the very rare subspecies *Rana areolata æsopus* Cope. Indeed, only the type specimen existed in the Museum collection, and of its habits nothing was known.

The desire to know something more of the gopher and its associates led me finally to undertake the laborious task of excavating and thoroughly examining one of their burrows. Accordingly, in January, 1893, I selected one of the largest burrows near my winter home at Crescent City and proceeded to open and inspect its inner recesses. The excavation was in the loose yellow sand of our pine woods subsoil, and when my exploration was completed, so large a pit had been dug that a coach and span of horses might have been swallowed up in it.

I had not descended many feet along the course of the burrow when I found that the walls and particularly the roof of the gallery were alive with specimens of a wingless cricket of the genus Ceuthophilus.

I next caught a glimpse of a very diaphanous Staphylinid, but so agile was this beetle and so like in color to the surrounding sand that several specimens slipped in succession through my fingers and escaped me. In subsequent explorations I recaptured this insect, which proves to be a Philonthus hitherto undescribed and remarkable for its slenderness of stature, its lack of color, and the distinctly subterranean appearance which marks a true cave insect and dweller in darkness. As I approached the end of the burrow, the sand became fairly alive with larvæ and imagos of a small Aphodius, also a colorless species, very subterranean in appearance. This is likewise an undescribed member of its genus closely allied to, but distinct from, common forms now living in the dung of domestic animals.

At the extreme end of the tunnel I found the gopher, quiescent but not dormant and resting upon a thin layer of fibrous material, evidently the winter accumulation of its excreta, in which could be plainly discerned the coarser and undigested portions of the leaves and vegetation which formed its food. Beneath this layer the sand was mined in every direction with the burrows of coprophagous insects, and I soon had a considerable collection, including a Trichopteryx, a new Histerid allied to Saprinus with its larva, and finally a Copris, which, from its size and general appearance, I took without doubt to be the universally distributed *Copris minutus* of our barnyards. But upon comparison with the known forms of the genus this proves to be quite a new and distinct species.

Besides the main deposit of dung upon which the animal was resting I found several smaller deposits which had evidently been pressed aside and partly imbedded in the sand by the movements of the turtle. These were all centers of attraction for the dung-eating beetles, but I found lurking in one of the masses a number of lepidopterous larvæ an inch or so long. Their dusky-brown coloration so closely corresponded with the material in which they lay concealed that I would probably have overlooked them had not their lively antics, their wriggling and twisting when disturbed made them very conspicuous objects. My first suspicion that these caterpillars were coprophagous was afterwards confirmed, and I ascertained that they eat the fresh dung of the turtle in preference to that which has been overhauled by other insects.

Only three burrows were opened in January, and of these one alone was inhabited by the gopher. In the month of July following I examined a larger number of gopher burrows, and in all eight galleries were carefully and thoroughly explored. The midsummer explorations greatly increased the knowledge previously gained of the habits of the gopher insects and added several new forms to the list. As most of these insects are new to science, detailed descriptions of them will be found at the end of this paper.

The following is an enumeration of the insects found in the gopher burrows, with the habits of each as far as I have been able to observe them.

COLEOPTERA.

(1) *Homalota* sp.—A small blackish species which has not been identified with any of those in our collections occurs in considerable numbers in the terminal "nest" of the turtle. It is not at all a striking form, and belongs to a group of numerous and, for the most part, unstudied species, many of which live in dung. To name and describe it at this time would only add to the confusion already existing in this and other genera of North American Aleocharinæ.

(2) *Philonthus gopheri* n. sp. —Occurs sparingly in many burrows. The larva was not discovered, but it presumably feeds upon the other insects in the burrows.

(3) *Trichopteryx* n. sp.—A brown species allied to *T. ambigua* Matthews. Abundant in accumulations of old dung at the end of many of the burrows.

(4) *Chelyoxenus xerobatis* n. g. et. n. sp.—Very common, burrowing in the sand in all parts of the galleries. Its larva was also found among the coprephagous larvae in the dung, and I have reason to believe that it is carnivorous but not predatory, *i.e.,* it feeds only upon the dead or dying insects.

(5) *Saprinus ferrugineus* Marseul.—A single very small specimen of this common Floridian species was found in a gopher hole on July 15. This is the only one of the Coleoptera found associated with the gopher, which also occurs above ground.

(6) *Copris gopheri* n. sp.—Specimens were found in every gopher hole examined, and were frequently abundant. Eighty-four specimens were collected in a single burrow. The female forms food-balls of gopher dung, after the manner of related species above ground. In each of these she lays a single egg, and then buries it 4 or 5 inches deep in the sand beneath the floor of the gallery. The material in these balls is finely fibrous and dark green in color. The larva begins eating near the surface of the ball and forms a cavity considerably larger than its body by pressing outward the dung, thus disturbing the sphere and rendering it more or less pear-shaped. In this operation it is evidently assisted by the peculiar hump on the back, so remarkably characteristic of the larvæ of this genus. The larva does not consume the whole of its food supply, but disintegrates the greater part of the mass, converting it into a friable, black earth which falls away at a touch. It finally constructs an oval cocoon within the ball, with rather thin and brittle walls formed from this black earth, cemented by saliva or some other secretion, and in this completes its transformations. In the burrows which contain egg-balls, specimens of the imago are less common, and there appears to be a continuous succession of broods throughout the year.

(7) *Onthophagus polyphemi* n. sp.—I did not find this beetle in the few galleries examined in winter, and it was probably in pupa at that season. In July it was not rare. One of the burrows produced twenty-one specimens. Its larva was not seen.

(8) *Aphodius troglodytes* n. sp.—This is the commonest of all the gopher insects. It swarms by hundreds in many burrows and is present in all of them. Young in all stages are found at all times in the deposits of dung which are rapidly disintegrated by them. The extremely pellucid and diaphanous integument of the imago in life, permitting every vein and fold of the wings to be plainly seen through the elytra, can not be confounded with the appearance of other pale species of the genus found above ground, and indicates a subterranean mode of life. This habit is also shown in the active but aimlessly wandering movements of the beetle and its evident distress when exposed to the light.*

LEPIDOPTERA.

(9) *Deltoid* (?) *moth.*—A sooty-brown caterpillar about an inch long, which occurs rather sparingly in most of the gopher burrows and feeds upon the dung, is perhaps the most interesting of the scavengers connected with the tortoise. Its body is naked, but with many transverse folds, and each segment bears a double row of tubercles, surmounted by stout, truncate spines. The thorax is marked with a narrow chitinous shield. The prolegs are armed with a bundle of hooked hairs, by means of which it easily climbs the walls and roof of the gallery, clinging to a few strands of invisibly fine web thrown over the loose sand.

In all probability this caterpillar is the larva of an undescribed Deltoid moth. It is well known that the feeding habits of some members of this family differ from those of other lepidoptera. The larvæ of at least two species of Helia are myrmecophilous, feeding no doubt upon the dead vegetable substances gathered by the

* *Anthicus ictericus* Laf. A single specimen of this beetle, which is common in the surface sand in Florida, was found in excavating one of the burrows among the gopher insects. Its presence was no doubt accidental.

ants. Other deltoids are known to feed upon dry leaves, but no lepidopterous larva has ever been observed to live upon the excrements of any animal.

The larvæ taken in January were full grown and were evidently hibernating. Two specimens formed naked pupæ, which were finally destroyed by mold, and I failed to breed the moth. In July the larvæ found were young, and proved to be exceedingly delicate and difficult to rear. Most of the specimens immediately died when taken from the cool retreat of the gopher and exposed to the light and heat of the sun. By taking extraordinary precautions I at last succeeded in domiciling two specimens in a tightly closed Mason jar, partly filled with moist sand taken with them from the gopher hole. I supplied these caterpillars with fresh dung from a gopher kept in confinement. They fed upon this at night, or when the jar was darkened by a thick covering. When captured (July 18) they were about one-third grown. In three weeks they consumed or disintegrated about three cubic inches of the dung placed from time to time in the jar, and nearly doubled in size. In August they were taken North to Detroit, Mich., where they soon began to hibernate and stopped feeding. Both subsequently died without pupating.

ORTHOPTERA.

(10) *Ceuthophilus latibuli* Scudder, n. sp.—This wingless cricket is found in all stages of growth and in great numbers in every burrow. They crawl readily along the sides and roof of the gallery, waving their long antennæ and behaving in much the same manner as their relatives in the caves.

CHERNETIDÆ.

(11) *Chelanops affinis* Banks, n. sp.—Five or six specimens of a pseudoscorpion were taken in the débris at the end of the galleries. One was collected in January; the remainder in July.

IXODIDÆ.

(12) *Ornithodorus americanus* Marx, MS.—The young of this tick infested one of the burrows opened in July. They were full of the blood of the turtle, but had not attached themselves to the body of the animal, and I conclude that they do not do so until they become adult. The mature ticks are sometimes found upon the gopher, adhering to the leathery skin behind the legs, after the manner of ticks generally. The young ticks of all sizes, to the number of twenty or more, were found in the terminal débris, and scattered along the gallery half way to its mouth. The species has been found in Texas in the nostrils of horses, and upon the llama in South America.

(13) *Amblyomma tuberculatum* Marx, n. sp.—A single specimen of this large and handsome tick was found attached to one of the sutures of the under shell of a large gopher, with its beak firmly inserted in the ligaments. I have no further knowledge of its habits. *

This interesting association of messmates and parasites of the gopher tortoise forms a distinctly subterranean fauna, in which the genesis of true cave life is very instructively shown. The differentiation of the various forms from their allies above ground has, it is true, not pro-

* *Thelyphonus giganteus* Lucas.—A very large specimen of the Whip-tailed Scorpion was found in a small gallery of its own, connecting with that of the gopher at a point about six feet beneath the surface of the ground. It is merely an intruder, and probably feeds upon the crickets.

A flea found in one of the burrows was probably left behind by some mammal that had visited the gopher hole.

ceeded so far as to produce profound modifications of structure, and only in a single instance the erection of a new genus was deemed advisable. The absence of eyes and the substitution of sensitive bristles as delicate tactile organs to compensate the loss of sight in cave insects, are results of a life in total darkness. In the twilight and incomplete isolation of the gopher burrows so radical a change is not likely to be effected. Nevertheless the variation that has been produced by this half cave life is sufficiently pronounced. It is shown in many of the species by a loss of color, a general tendency to suppression of punctures and protuberances, a more glabrous surface of the body, and greater slenderness of form than is found in related species.

The origin of some of the Coleoptera, at least, is plainly indicated by their close relationship with forms living outside of the burrows. Thus *Copris gopheri* may have been derived from *C. minutus*, with which it agrees closely in size and shape, as well as in general structure. *Aphodius troglodytes* is also very nearly related to *A. stercorosus*, which inhabits the same region. Both the Copris and the Aphodius differ from their congeners notably in smoothness of surface and general tendency to obliteration of sculpture. The differentiation in each case is such as may be supposed to have been brought about by a life under ground. The chitinous integument in both these beetles shows some change. In the Copris it matures very slowly and frequently fails to attain the normal black color. The Aphodius, although belonging to a group of light-colored species, is by far the most thinly chitinized form in the genus, and in life is as colorless as an Anophthalmus. The eyes, too, are smaller and the legs more slender than is usual among its allies. In *Onthophagus polyphemi*, likewise, important distinguishing characters are found in its narrow eyes, its polished, glabrous surface, and the absence of protuberances and of punctures upon the thorax, especially in the male, which seems to differ more than the female from the type of Onthophagus common in our fauna. It is not related to any of our species, and appears to belong to a different group. It may be allied to some species in the West Indian fauna with which I am not familiar. The Staphylinid, *Philonthus gopheri*, is another insect which can not be affiliated with any other species of the genus. It is structurally allied to *P. longicornis* and one or two other black forms, but these belong to the circumpolar fauna and are not known to occur in Florida. Our present system of classification does not necessarily indicate natural relationship in the Philonthi, and can not be said to give the true affinities of this species. Its lack of color shows it to be a subterranean form, it is also remarkably slender and feebly punctate, and has slender legs and unusually long, fine claws.

Especially noteworthy in respect to its affinities is the new Histerid, *Chelyoxenus xerobatis*. This species, although structurally closely related to the genus Saprinus, present a character which is not paralleled in

any other Histerid genus in our fauna, while at the same time its resemblance to a Hister is quite remarkable. I believe it to be an ancient form, not modified by its underground life, but preserved from extinction by its isolation or the favorable conditions of its environment.

In the foregoing study of the Coleoptera, which are closely connected with the economy of the gopher and have probably been long associated with it as scavengers, there will be found reasons for believing that this assemblage includes not only species differentiated from forms substantially the same as those now existing on the surface, but others, extinct outside the burrows, which have survived because of their environment and may not have been modified by it.

That a gallery in the sand of such diminutive proportions as a gopher's burrow can harbor such a large number of hitherto undiscovered insects, and afford an environment potent to effect such changes in the structure and life of animals, might well seem incredible, were it not for the very unique conditions which here exist. The moisture of the subsoil does not vary. The temperature of the burrows varies but five degrees throughout the year; the extreme in winter being 74° F., and in summer 79° F. The tortoise is a reptile of ancient lineage, whose burrowing habits were probably established in ages zoologically remote. It is a long-lived animal, and its habitation once completed is maintained and occupied for a very long series of years.

DESCRIPTIONS OF NEW SPECIES.

Philonthus gopheri n. sp.

Form slender, parallel. Color reddish-testaceous, shining, pubescence golden, head with a dark band behind the eyes. Head as wide as the thorax, longer than wide, widest across the eyes, with a few coarse punctures behind the eyes. Antennæ slender, as long as the head and thorax combined, all the joints longer than wide. Thorax slightly longer than wide, not narrowed in front, sides straight, slightly sinuate, punctures of the dorsal series four in number, moderately coarse, the posterior more distant. Elytra conjointly rather longer than wide, slightly longer and wider than the thorax, moderately densely, but not coarsely punctate, sparsely pubescent. Abdomen finely, rather densely punctured, punctures beneath rather coarser and sparser. Tarsi of hind legs long and slender, the claws very fine and long.

Male.—Front tarsi moderately dilated. Last ventral segment with a wide and deep triangular emargination, surrounded by a narrow gutter which does not extend forward at middle.

Female.—Head as large as in the male. Front tarsi much less dilated. Last ventral segment simple.

Length 5.6 ^{mm}.

Described from eight specimens, Crescent City, Fla.

Related to *P. varians* and *P. longicornis*, but distinguished by its slender form, pale color, larger head, by the form of the thorax, which is not narrowed in front, and the deeper emargination of the last ventral segment in the male. The antennæ are longer and more slender, the elytra less densely punctured and the tarsi much longer than in *P. varians.* It does not have the muricate punctuation of the elytra seen in *P. longicornis*; the latter is also somewhat larger. The eyes are rounder

and more protuberant in *P. gopheri* and are placed lower down on the sides of the head, so that they can be seen from beneath; in both the related species the eyes are flat. more elongate and are not visible from beneath.

From *P. discoideus* it is readily distinguished by the long antennæ and the sexual characters of the male. As is the case with *Aphodius troglodytes* this insect turns darker after death. In life its color is pale yellow like the sand in which it lives.

Chelyoxenus n. g.

Head retracted; antennæ inserted under margin of the front; prosternum not lobed anteriorly, convex, bistriate; antennal fossæ immediately in front of the anterior coxæ; mesosternum truncate anteriorly; elytra with five dorsal striæ, the four outer ones nearly entire, the fifth abbreviated and usually appendiculated at apex; pygidium triangular, convex, greatly and rather suddenly inflexed apically; femora not incrassated; front tibiæ dilated and multi-dentate; middle and hind tibiæ slender, biseriately spinose; tarsi of middle and hind legs slender; claws strikingly unequal in length: the inner one very slender and almost as long as the claw joint, the outer one spine-like and only about one-fourth the length of the inner claw.

This new genus of Histeridæ is proposed for a rather small species which agrees with Saprinus in all essential characters excepting the structure of the tarsal claws. Uni-unguiculated genera of Histeridæ are known both in the Histrini (Cypturus and Monoplius) and Saprini (Xiphonotus), but I am not aware that a genus has been described exhibiting a marked inequality of the claws. Superficially, this genus may be distinguished from Saprinus by the more complete elytral striation and also by the somewhat less ovate and less convex form of the body.

Chelyoxenus xerobatis n. sp.

Oval, shining, black, without metallic reflections. Head sparsely, minutely punctulate, front not margined, supra-orbital stria distinct, extending a short distance upon the front. Thorax fully twice as wide as long, sides convergent anteriorly and nearly straight from the base to apical fourth, thence arched; a single marginal stria; very finely and sparsely punctulate on the disk, more coarsely and densely on the sides. Elytra at apex finely, sparsely and rather irregularly punctate, the punctures extending slightly between the striæ, the remainder of the elytral surface very minutely and sparsely punctulate; a single very long subhumeral stria usually but slightly abbreviated at either extremity, sometimes interrupted or obsolete anteriorly; oblique humeral stria long, distinctly impressed; dorsal striae 1 to 4 subequal in length, extending from the base nearly to the apex of the elytra, deeply impressed and obsoletely punctured, not hooked at base, fourth arched at base, joining the sutural stria, which is strongly impressed and entire; between the fourth dorsal and the sutural a strongly impressed

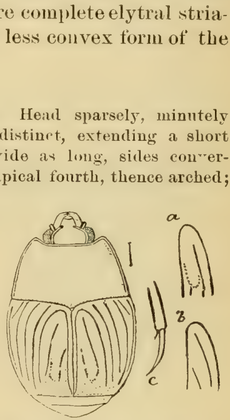


FIG. 19.—*Chelyoxenus xerobatis: a, b,* variations in elytral sculpture; *c,* claw of left hind leg—enlarged (original).

fifth stria of varying length, beginning sharply a short distance below the arch, frequently interrupted and continued by punctures at the apical end, where it is accom-

panied by a hook; the hook consisting of punctures which often become confluent, extending obliquely forwards toward the sutural stria and forming a short but distinct sixth dorsal stria; apical line feeble at the suture. Epipleuræ smooth, without striæ. Prosternum strongly convex but not carinate, nearly smooth; striæ entire, diverging, ascending, becoming horizontal and entering a deep but narrow fovea, thence converging and uniting on the anterior margin of the prosternum. Propygidium and pygidium with rather dense, shallow punctures, the latter without marginal groove and on the inflexed, apical portion with a smooth median line which, in some specimens, is slightly elevated. Mesosternum finely punctate. Metasternum nearly smooth at middle, coarsely punctate behind and on the sides. Front tibiæ with six or seven stout teeth, each armed with a spine; middle and hind tibiæ biseriately spinulose; the hind tiba at apex as wide as in the middle.

Length 3 to 3.8^{mm}.

Numerous specimens taken from gopher holes, Crescent City, Fla.

The curious apical hook which accompanies the fifth dorsal is very variable and often obsolete or represented by a line of scattered punctures. In many specimens the curve of the hook is obliterated, the remaining portion appearing as a stria supplementary to the fifth dorsal. When strongly impressed and complete it is seen to be disconnected from the fifth stria as is shown at *a* in the accompanying outline sketch. (Fig. 19.)

The complete striation together with the smoothness of the elytra give to this species the appearance of a Hister rather than a Saprinus.

I am greatly indebted to Dr. George H. Horn for having my attention called to the peculiar structure of the tarsal claws, and it is by his advice that a new genus has been established upon this species.

Copris gopheri n. sp.

Oblong-oval, black, shining. Head and thorax sparsely and finely punctulate. Clypeus acutely not deeply emarginate, feebly sinuate on either side of the notch. Genæ rectangular. Thorax declivous in front and without prominences. Elytral striæ shallow, obsoletely punctured, interspaces smooth.

FIG. 20.—*Copris gopheri* n. sp.—enlarged (original).

Color black, varying to chestnut brown, many specimens failing to reach full maturity of the chitine. Surface highly polished, shining. Head minutely punctured, larger obsolete punctures occurring around the margin; clypeal emargination acute, moderately deep, the dentation on either side indicated by feeble sinuations; horn of the vertex stouter than in *C. minutus* and having upon its posterior margin a minute protuberance; in a few specimens the horn is reduced to an acute tubercle. Eyes above narrow, about twice as long as wide. Thorax with the declivity in front moderately abrupt, not vertical, without protuberance in either sex, at most slightly sinuate on each side; upper surface sparsely and obsoletely punctulate with denser and deeper punctures at the anterior angles; sublateral impression rounded, moderately deep; median channel more or less obsolete. Elytra with eight rather fine striæ; the eighth stria extending from near the humerus to the middle of the elytra, indistinctly punctured, the other striæ distinctly punctured,

except at apex; interspaces very slightly convex and entirely smooth. Undersurface smooth on the disk, punctured on the sides. Legs and tibial spurs as in *C. minutus,* the tooth on the outer margin of hind tibia smaller.

Length 7.5 to 10^{mm}.

Described from many specimens found in gopher holes at Cresent City, Fla.

At once distinguished from all our species by the brilliant polish and minute, inconspicuous punctuation of the upper surface. In size and shape and in the armature of the head and legs, as well as in the form of the tibial spurs, it agrees with *C. minutus*, from which it differs in the suppression of the punctuation, the feebly indicated, often obsolete clypeal teeth, the smaller and narrower eyes and the absence in both sexes of thoracic prominences. The elytral interspaces are less convex, and the eighth elytral stria is greatly abbreviated.

C. gopheri appears to have differentiated from *C. minutus* in comparatively recent times, and has attained a degree of divergence which in this group is universally recognized as having specific value. The large series of specimens from a single locality, Crescent City, Fla., do not show any tendency to variation, and unless intermediate forms occur elsewhere, the two species must be considered distinct.

Onthophagus polyphemi n. sp.

Oval, shining, black, antennæ, trophi and legs piceus; head, elytra, and part of thorax with sparse, long, erect, reddish hairs arising from the punctures. Head coarsely and sparsely punctate. Clypeus semicircular, somewhat truncate in front, not sinuate or dentate on the sides; margin reflexed; clypeal carina arcuate, vertical carina varying according to sex. Eyes above narrow, three times as long as wide. Thorax in form, sculpture, and pubescence varying in the sexes, wider than the elytra; sides seen from above scarcely rounded; anterior angles not acute. Elytra with seven finely punctulate striæ, the seventh stria arcuate, ending abruptly at a smooth humeral callus; interspaces not convex, shining, biseriately punctate. Episternum of prosternum horizontal, slightly excavated anteriorly for the reception of the antennal club. Mesosternum smooth at middle, rather sparsely punctate on the sides. Front tibiæ quadridentate, the upper tooth small.

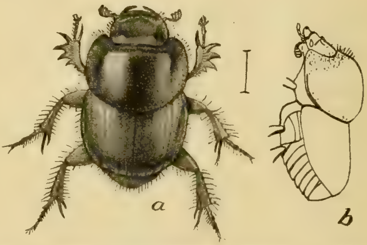


FIG. 21.—*Onthophagus polyphemi* n. sp.: *a*, ♂, from above; *b*, do., side view—enlarged (original).

Male: Vertical carina obsolete at middle, more or less tumid at the ends, sometimes reduced to a pair of feeble tubercles. Thorax strongly convex, much higher than the head, nearly vertical in front, crest of the declivity not protuberant but forming on each side a slightly elevated, obtuse ridge; surface of the thorax smooth and brilliantly polished, anterior angles and declivity, except at middle, densely punctate, sides sparsely punctate, the punctures extending some distance along the basal margin.

Female: Clypeus longer than in the male, less broadly truncate, vertical carina straight, entire. Thorax slightly convex, scarcely higher than the head, without declivity in front, surface strongly and unevenly punctate, the punctures on the disk much sparser and finer.

Length 5.5 to 6.7^{mm}.

Described from numerous specimens found in July in gopher holes at Cresent City, Fla.

The sexual characters vary greatly in degree of development. For the above characterization of the sexes the most strongly marked specimens have been selected. In the large series before me there are individuals in which the sex can with difficulty be determined. The anterior tibiæ are equally stout in both sexes, but the distance between the front margin of the clypeus and the carina on its hind margin is always greater in the females than in the males and affords the best guide for the recognition of effeminate males.

In the male the vertical carina is sometimes nearly entire, the thorax is often less globose and in its form approaches that of the female. In such cases the anterior declivity disappears, and the punctuation extends more or less over the disk. The females vary less than the males, but the ends of the vertical carina are sometimes slightly tumid. The punctuation of the thorax is also variable and the disk is occasionally nearly smooth.

In addition to its peculiar sexual characters, the shining surface and sparse punctuation, even in the females, sufficiently distinguish this from all other North American species. All hitherto described species in our fauna have the pro-episternum excavated for the reception of the antennæ, the excavation beginning at the suture. In *O. polyphemi* this sclerite is very slightly excavate on its anterior face only, the greater portion of its surface being horizontal.

Aphodius troglodytes n. sp.

Belongs to group I-b of Dr. Horn's Monograph of the Aphodiini (Trans. Am. Ent. Soc., Vol. XIV, 1887.). Color, honey yellow, or reddish yellow. Head without ante-ocular impression, very sparsely and finely punctulate in both sexes, nearly smooth in front; eyes small, partly retracted into the thorax, finely granulate. Thorax finely punctulate, the punctures growing denser and somewhat larger on the sides, but without intermixed coarse punctures. Elytral interspaces with sparse, fine punctures, equally minute in both sexes. Hind legs and tarsi slender; the first tarsal joint longer than the three following joints; the two spurs nearly equal in length.

Length 3 to 3.8^{mm}.

Very closely allied to *A. stercorosus*, but differs by the absence of an ante-ocular impression and by the character of the punctuation, which is always finer and does not vary in the sexes. The intermixed larger punctures upon the sides of the thorax are wanting in this species. The eyes appear less convex on account of the obliteration of the ante-ocular groove; they are usually in great part covered by the thorax and are appreciably smaller. The hind legs are more slender and the tarsi longer than in *A. stercorosus;* the first tarsal joint is always longer

than the longer spur, while in *A. stercorosus* the first tarsal joint is seldom longer, and in some females shorter than the spur.

The color in life is a transparent honey yellow, which becomes darker and turns red in seasoned cabinet specimens, but never exhibits any cloudiness upon the elytra. The head and thorax are never darker than the elytra.

Described from numerous specimens collected in gopher holes at Crescent City, Fla.

The species is evidently derived from *A. stercorosus*, which inhabits the same region, and it agrees so closely with this well-known species that a more detailed description is deemed unnecessary.

The table given by Dr. Horn in his monograph (*l. c.*, p. 34) may be extended to include the new species as follows:

Posterior tibiæ stout; first joint of posterior tarsus not as long as the next three; head with ante-ocular impression.................................... *rubeolus.*
Posterior tibiæ slender; first joint of posterior tarsus longer than the next three.
Head with ante-ocular impression; sides of thorax with large and small punctures intermixed .... *stercorosus.*
Head without ante-ocular impression; sides of thorax finely punctulate, without coarse punctures.. *troglodytes.*

Specimens of the Ceuthophilus were sent to Mr. S. H. Scudder, who has come to the conclusion that the species is undescribed. I have his permission to insert his description in this paper.

Ceuthophilus latibuli Scudder, sp. nov.

Dark brownish fuscous, heavily blotched with ferrugineo-testaceous, largely in the form of small longitudinally ovate spots more or less regularly disposed on the dorsum, but inclined to be confluent on the sides and forming blotches on the pronotum; the hind femora dark, with two series of longer and an intermediate series of shorter oblique testaceous lines; all the tarsi and at least the apical half of the tibiæ pallid luteous. Legs long and slender. Fore femora less than one-third longer than the pronotum, the inner carina armed with 2 to 4 longer or shorter spines on the distal half. Mid femora with 2 to 3 usually long spines besides a subapical spine on the anterior carina, and on the posterior carina a very long genicular spine, besides sometimes an additional spine. Hind femora about as long as the body, rather stout, but more than the distal fourth slender and subequal, the whole three (♂) to three and a half (♀) times longer than the greatest breadth; the outer carina slightly prominent, unarmed (♀) or furnished with 8 to 9 rather unequal. inequidistant short spines, the longest not half the length of the tibial spurs; inner carina with 6 to 8 inconspicuous (♀) or 13 to 16 small inequidistant (♂) spines, the intervening sulcus rather deep but of moderate breadth. Hind tibiæ much longer than the femora, straight, slightly compressed at the base, beneath with 1 to 2 preapical median spines besides the apical pair; spurs not opposite, the basal generally by or before the end of the proximal fourth of the tibia, nearly or quite twice as long as the tibial depth, set at an angle of about 60° with the tibia, and of about 120° more or less with each other, slightly incurved at tip; inner middle calcaria very slender, considerably longer than the first tarsal joint or than the outer middle calcaria and twice as long as the other calcaria or the spurs. Hind tarsi distinctly less than half as long as the tibiæ, the first joint not nearly equaling the rest together, the second and third together shorter than the fourth. Cerci slender, delicately tapering, about as long as the femoral breadth. Ovipositor straight,

rather slender, from a third to more than half as long as the hind tibiæ, the tip hardly upcurved and exceedingly acute, the denticulations of the inner valves triangular, hardly aculeate.

Length (single specimen measured) of body, ♂, 18^{mm}, ♀, 17^{mm}; antennæ, ♂, 55^{mm}, ♀, 65^{mm} (est.); pronotum, ♂, 5^{mm}, ♀, 6^{mm}; fore femora, ♂, 8^{mm}, ♀, 8.5^{mm}; hind femora, ♂ ♀, 18^{mm}; hind tibiæ, ♂ ♀, 19.5^{mm}; ovipositor, ♀, 10^{mm}.

Described from 4 ♂, 5 ♀, besides 3 immature ♂.

Crescent City, Fla., in gopher burrows (H. G. Hubbard); Georgia (H. K. Morrison).—[Scudder]

The following description of the pseudoscorpion found in the gopher burrows has been kindly furnished by Mr. Nathan Banks.

Chelanops affinis Banks, n. sp.

Length 2^{mm}. Pale yellowish, legs and abdomen whitish. Cephalothorax and abdomen with clavate hairs; those on palpi less clavate. Trochanters of palpi with globose projections above; femora slightly pedicellate, very little broader near base than at apex; tibiæ moderately swollen on inner side, slightly broader than femur and nearly as long; hand about as long as tibia and much broader, tapering to the fingers, the latter a trifle longer than hand, moderately curved. Abdomen quite broad, the segments indistinctly divided; legs more slender than usual.

Closely related to *Ch. pallidus* Banks, differing principally in the more swollen tibia, more slender and more pilose hand, and the longer legs.

Crescent City, Fla.—[Banks.]

To Dr. George Marx, of Washington, D. C., I am indebted for the following description of the tick found upon the Gopher.

Amblyomma tuberculatum Marx, n. sp.

Female: very large, suborbicular; length of body 7.6^{mm}.; length of capitulum 3^{mm}. Capitulum dark reddish-brown with a pale testaceous, narrow transverse band behind the front margin which extends in the middle, between the two glandular depressions into a round spot. Palpi reddish-brown with the basal part of the second joint pale testaceous, rostrum pale testaceous, shield dark reddish-brown with silvery figurations; abdomen of the same color, legs with narrow whitish tips of the joints. Underside: capitulum posterior region, reddish-brown, frontal one white, maxillæ yellow testaceous; palpi, first joint with a reddish-brown triangular sclerite; second joint with yellowish basal half and reddish-brown terminal half; third joint reddish-brown; coxæ dark brown; body brownish-yellow.

Capitulum longer than broad with rounded posterior and lateral margins without projecting postero-lateral angles, the glandular depressions oval, obliquely outward and deep. Palpi, first joint free, second joint with a long basal part, itself short and triangular, not quite double as long as wide, drawn out at inner basal angle into a point which, however, forms no projection, but runs into a ridge down to the first joint, underside at distal end projecting over the third joint; third joint as broad as long, basal margin with a sharp, short tubercular projection, maxillæ long, attenuate in the middle and with the tips clavate; armature, four rows of spinous plates on each side, occupying only one-fourth of the length, and the rest covered with flat, fish-scale-like plates which gradually diminish in size toward the base; mandibles as long as palpi, sheath with a furrow in the middle. Shield finely punctured, clypeus flat, sulci comma-shaped, very deep, a shallow impression behind them; abdomen without punctures, with distinct lateral groove and posterior lobes and three dorsal longitudinal lines behind the shield; underside, finely punctured, with short white hairs in the punctures; legs long and slender with sparse short white hairs; coxæ I with a short, round tubercle on the antero-internal region; the four coxæ with two flat and sharp tubercles obliquely above the posterior margin; at coxæ I the external

tubercle is narrower than the internal; in coxæ II both are of even width, and in coxæ III and IV the external one is broadest. Stigma, subtriangular, cancave with raised borders, external angle interrupted with a broad button-shaped lapel; peritreme flat, comma-shaped, straight, orifice oval.

Male: suborbicular; length of body 6^{mm}; length of capitulum 2^{mm}.

Capitulum of the same color as in female; dorsum reddish-brown with metallic (green and gold) supra-marginal band and some figurations of the same color over the surface, underside bright yellow; legs as in female.

Capitulum about as long as broad, with rounded posterior and lateral margins without projecting postero-lateral angles and without the ocelli-like impressions; maxillæ, palpi, as in female, dorsum uniformly and finely punctured with some single larger punctures in the posterior region; lateral groove absent, posterior lobes distinct, clypeus, underside and coxæ as in female. Stigma more subreni-form with a broad and long lapel on the external side. Coxæ I is provided also with a short round tubercle at the antero-internal region as in the female.

Described from two specimens from Florida, one of which was found upon the Gopher at Crescent City.—[MARX.]

My grateful acknowledgments are due to Mr. E. A. Schwarz, of Washington, for valuable assistance and suggestions in the preparation of this paper.

THE CONTROL OF PHYLLOXERA BY SUBMERSION.

We have from time to time referred in these pages to the results which have been obtained in Europe, and notably in France, in controlling the Phylloxera by flooding the vineyards at certain seasons of the year for definite periods, known as submergence, which has, of all the direct methods against this notable grape pest, proved most surely effective in its results, the sole objection to it being the expense attending it and the impossibility of applying it except in regions which are favorably situated. The submergence of vineyards for other than irrigation purposes did not originate with the invasion of the Phylloxera, for from time immemorial it has been the custom in south Russia and in Greece to inundate vineyards during winter to rid them of hibernating insects and snails. As a means against the Phylloxera it was first employed by Dr. Seigle, of Nimes, in July, 1868. A canal surrounding his property, leading from the River Durance, was taken advantage of to inundate his vineyards for twelve consecutive days during July, and again for eight days in October of the same year, and in the following year three inundations were made, with the result that the Phylloxera was entirely exterminated.

The practical outcome of the experiment resulted in the adoption of the method wherever feasible. All soils are not equally suited to this treatment—the best results obtaining in soils which the water will penetrate from one to five centimeters in twenty-four hours. If the soil is so loose and sandy that the water reaches a depth of eight to ten centimeters in this time, the amount of water required will be so great as to render submersion impracticable.

The usual French method consists in dividing the vineyard up into squares or rectangular plats—the former for level and the latter for sloping surfaces—by walls or embankments of earth, these latter being protected from erosion by planting them to some forage crop, commonly White Clover. During the first season the walls are still further protected by coverings of reed-grass, cuttings, twigs, etc. Where possible, canals are taken advantage of as water supplies, but most of the submersions are accomplished by the use of centrifugal steam pumps as represented in the annexed illustration (Fig. 22).

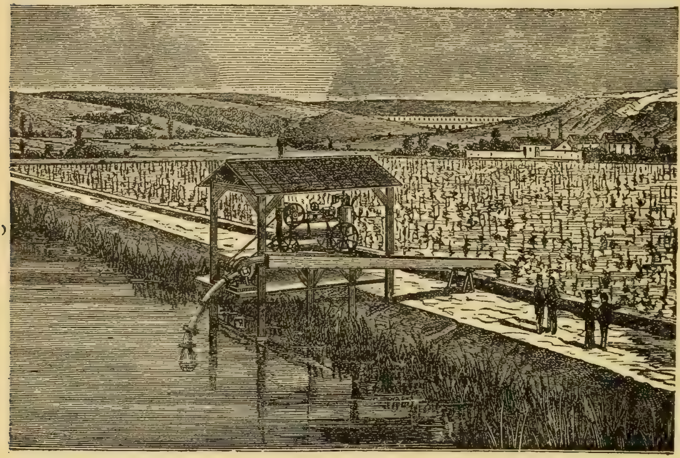


FIG. 22.—Inundating vineyard with centrifugal steam pump. (From Report U. S. Commissioners to Paris Exposition, 1889.)

A recent article, by Prof. B. Chauzit, in the *Revue de Viticulture* (vol. I, No. 4, January, 1894), gives a very succinct and interesting statement of the later methods of treatment in France, which are briefly summarized below:

Following the discovery of the efficiency of submersion, the first ten years, from 1873 to 1883, witnessed the planting in France of thirty thousand hectares of vineyards to be protected by this method; but since the latter date the area of vineyards annually submerged has not very greatly increased. This is due solely to the fact that the use of resistant American stocks, upon which the more susceptible European varieties are grafted, has been attended with such satisfactory results, is so much less expensive, and is capable of employment in all districts and soils; so that the more expensive, if more certain, method of submersion, has not of late years been very much extended. Wherever, however, this method of controlling the Phylloxera has been introduced, often at considerable outlay, there has been no thought of aban-

doning it, and in no case have any of the injurious results which were feared from it at the outset been realized. For instance, the soil has not been appreciably changed in character by the loss of constituent elements, or at least not more than can be easily replaced by suitable fertilizers; nor has there been any packing or other physical changes injurious to vine growth.

In the earlier method of submersion as practiced during the dormant winter period, the length of time during which it was necessary to keep vineyards under water ranged from forty to sixty days; a period which entailed various inconveniences in the matter of amount of water and expense. The aim in more recent years has been to reduce the length of the submergence to as few days as possible, and it is now established that if the application be made during the active period of the Phylloxera, the duration of submergence may be greatly lessened or reduced to from eight to twenty days. It is also very important that the time for submersion should be so chosen that the growth of the plant will not be checked, and both these results are now accomplished by subjecting the vines to the treatment shortly after the gathering of the fruit. At this period the vines have already ceased active growth, but the Phylloxera is still in its full activity and development, and is much more readily influenced by submersion than during the dormant winter period. In general, the earlier the application the shorter the period required, as, for instance, during September, eight to fifteen days will suffice, or in the first half of October fifteen to twenty days, while if it be delayed until November the old period of forty to sixty days will be needed to insure satisfactory results. In connection with the short fall submergence it is found advisable, also, to practice summer irrigation. This operation, which should be the invariable complement of the short autumn submersion, is commonly performed during July, and the amount of water run over the vineyards is very abundant, amounting practically to a forty-eight-hour submersion. At this season submersion or irrigation for the length of time given is most useful to the vines, as it is a period when drought is more or less apt to be prevalent and the beneficial result to the vines themselves largely compensates for the expense of treatment. The surviving Phylloxeræ are also now in active development and most readily destroyed. Successful summer treatment necessitates the training of the vines well above the soil, the surface of which should be carefully leveled.

The vineyards of France where this process is followed are, as a general rule, very productive, and the quality of the fruit and wine product is fully equal to that obtained under normal conditions. It may be that the future will witness the abandonment of this means of controlling the Phylloxera, by the gradual introduction into those districts of the use of resistant American stocks, but this is hardly likely in view of the substantial benefits derived from the treatment, in addition to the very effectual control of the Phylloxera; and if, as stated at

the outset, the increase of submergible areas has not greatly extended of late years, it is to be explained by the cheaper and quite satisfactory results obtained with resistant stocks.

The thoroughly satisfactory results obtained by submersion in France have a particular interest for us on account of the appearance of the Phylloxera in California, where irrigation is largely practiced and where it will be comparatively easy, in many cases, to submerge vineyards in accordance with the methods of the French viticulturists.

The Phylloxera difficulty in France has, after years of discouragement and loss, led to results which have a very substantial value, for it has necessitated an intensive careful culture after improved methods, has led, in many cases, to smaller holdings, and has resulted in better and more abundant and uniform harvests.

With the spread of the Phylloxera scourge over Europe, delegations of viticulturists from Switzerland, Austria, Roumania, and Hungary, have visited France to acquaint themselves with the approved French methods—the information sought being cheerfully given—and recently by request some French experts have visited the region about the Crimea, where the Phylloxera has extended its range within the last few years, to give instruction in methods for eradicating or at least limiting its damage

---

ACORN INSECTS, PRIMARY AND SECONDARY.

By MARY E. MURTFELDT, *Kirkwood, Mo.*

Until one carefully examines the acorns of this section of the country it is impossible to realize to how great an extent they are destroyed by insects. Among the latter one or more species of nut-feeding Curculios of the genus Balaninus are the principal depredators. But within recent years a Lepidopterous larva, that may be designated as the Acorn Melissopus, has so multiplied as to become scarcely second to the beetle larvæ in destructiveness; while a third small percentage of the nuts are infested with Cynipid galls and other insects, so that the sound acorns that can be collected during the months of October and November are an almost incredibly small proportion of the entire product of the trees.

During the past autumn I examined many hundreds of acorns of the various species of Quercus abounding in this locality, keeping records of the fruit infested by different insects and making the average of four or five hundreds of each from which to arrange a tabular statement. The result seemed sufficiently remarkable to merit the notice of those interested in forestry and general arboriculture.

The species of Oak most abundant in this vicinity are the Post or Iron Oak (*Quercus stellata* Willd., *obtusiloba* Mx.), Black Oak (*Q. tinctoria*) in varieties, Laurel Oak (*Q. imbricaria*), Pin Oak (*Q. palustris*),

Black Jack Oak (*Q. nigra*), White Oak (*Q. alba*), (*Q. macrocarpa*, *Q. prinus*, and *Q. castanea*. I have not had opportunity to examine any considerable number of the acorns of the four last-named species, but such as I have seen show the work of the same insects as infest the others, of which I have had an almost unlimited quantity.

The following tables will be found approximately representative of the proportion of acorns destroyed by the different insects feeding upon them:

Post Oak (*Q. stellata*) acorns	100
Infested with *Balaninus quercus* and *uniformis*	60
Melissopus latiferreana	28
Sound nuts	8
Shrunken or mildewed nuts	4
Infested by Gelechia following Balaninus	25
Melissopus	5
Black Oak (*Q. tinctoria*) acorns	100
Infested with Balaninus	70
Melissopus	20
Cynipid galls	5
Sound nuts	5
Infested by Gelechia following Balaninus	30
Melissopus	6
Laurel Oak (*Q. imbricaria*) acorns	100
Infested by Balaninus	63
Melissopus	24
Sound nuts	13
Infested by Gelechia following Balaninus	14
Melissopus	9
Pin Oak (*Q. palustris*) acorns	100
Infested by Balaninus	25
Melissopus	10
Sound nuts	65
Have not found Gelechia in nuts of this species.	
Black Jack Oak (*Q. nigra*) acorns	100
Infested by Balaninus	35
Melissopus	50
Sound nuts	15
Gelechia following Balaninus	15
Melissopus	20

From these records it will be seen that the acorns of Pin Oak suffer least from the attacks of insects, that the Black Jack is most subject to the Acorn Codling, and that the Black Oak (*Q. tinctoria*) acorns are the only ones of which any appreciable percentage are, in this locality, infested with the Cynipid galls.

In the preparation of these memoranda the life histories of most of the species have been more or less completely worked out, and such biological facts and descriptions as have not heretofore been published may be perhaps not inappropriately recorded in this connection.

The acorn-feeding species of Balaninus (*B. uniformis* Lec. and *B. quercus* Horn) may be taken here, out of doors, as early as the first of

June, but in the rearing jar none have emerged for me before the 20th of July, and even at the latter date the acorns are not nearly grown. Oviposition takes place mostly during September. On the 29th of that month last year I had the good fortune to observe the process of oviposition in an acorn of Post Oak. While examining a bough for some other purpose a beetle, afterward identified as *B. uniformis*, alighted or crawled upon an acorn within plain sight, and after some preliminary examination finally braced herself with legs widely extended and with a slight upward and downward motion of the head and thorax began drilling into the side of the acorn just beyond the margin of the cup. It took some little time to penetrate the shell, although the latter was still green, but once through this the insect ate her way into the tender cotyledons until the beak was two-thirds buried in the acorn. In this position she remained almost motionless for what seemed several minutes, then slowly withdrew her beak and revolving as though on a pivot applied the tip of her abdomen to the shell, and finally with a delicate sense of touch found the orifice prepared by the beak into which, after considerable delay, the egg was inserted by the somewhat extensile ovipositor. She then again reversed her position and inserted the beak for the purpose, apparently of pushing the egg further into the tunnel excavated for it. As she was again withdrawing her beak I placed her, nut and all, into the collecting box. This transpired late in the afternoon and on the following day the acorn was carefully opened and the oblong, pellucid egg, about one millimeter in length, was revealed, placed on end in the cavity prepared for its reception. Several other eggs in more advanced stages of development were afterwards discovered. These had become somewhat opaque and the segmentation of the embryos was quite distinct.

The larger proportion of the Balaninus larvæ seem to develop with considerable rapidity and to leave the fruit to enter the ground before frost, but a considerable number may be found in acorns at almost any time throughout the winter. It is probable that these, under natural conditions, never develop, but when placed in the rearing jar some of these belated individuals have, for me, attained the perfect form. It is but rarely that two larvæ will be found within a single acorn, but when this occurs, although in small acorns such as those of the Post Oak, there is scarcely enough nutriment for two, yet what there is seems to be equally divided between them. The castings are usually very fine and very compactly pressed together, but in the acorns of the Black Oak sometimes take the form of short, dark threads, intermingled with the woolly fibers of the inner coat of the shell.

HABITS AND ADOLESCENT STAGES OF THE ACORN MELISSOPUS.

Melissopus (Carpocapsa) latiferreana, Wlsm.

This beautiful and interesting species which, with the exception of the Mexican Jumping Bean Moth (*Carpocapsa saltitans*), is the nearest

American ally of the Apple Codling Moth, was first described by Lord Walsingham from probably captured specimens from California, sent to the British Museum. It was placed in the genus Carpocapsa, with which the two available specimens, both females, seemed to sufficiently well agree. It was, however, subsequently ascertained that this description, from a single sex, failed to include certain peculiar and important characters pertaining to the males, namely the mat of spatulate scales near the inner margin of the under sides of the hind-wings and a brush-like tufting of the hind shanks and feet. These characters, with others, were defined by Dr. Riley in a paper published in the Transactions of the St. Louis Academy of Science (vol. IV, 1881), and were considered so divergent from those of any other Carpocapsa as to call for the erection of the new genus Melissopus—from two Greek words signifying "bee-footed" and most applicable to the densely-tufted hind tibiæ and tarsi of the males.

Dr. Riley's paper contained no account of the habits of the insect beyond the statement that it was "bred from acorns, either as a borer or an inquiline," nor, so far as I am aware, has any description of its immature stages ever been published. It is a true acorn feeder, almost contemporaneous in its different stages of development with Balaninus. The moths, like the beetles, are very irregular in date of appearance, beginning to emerge in May and continuing to do so until August. They are not attracted to lamp light and must be, I think, very rarely observed in the open air. Early in September last, between five and six o'clock in the afternoon, I noticed one on an acorn, possibly stationed for oviposition, but on my nearer approach for the purpose of a better view, although done with the utmost caution, the insect was disturbed and flitted away. This is the only one I have ever seen out of doors. The eggs are, in all probability, pushed just under the edge of the cup and the young larvæ find no difficulty in making their way through the most penetrable part of the shell. They begin feeding around the outside of the cotyledons and do not for sometime interfere with the ripening of the fruit.

The full grown larvæ vary in length from 10 to 20^{mm}, and the corresponding diameter is from 2 to 4^{mm}; form almost cylindrical throughout; color dingy white with pale, grayish-brown, glossy maculæ, from which arise very short and fine light hairs. These piliferous spots are largest on the posterior segments and the two dorsal ones often become confluent on the eleventh segment, forming a transverse, oblong band, on each side of which is a somewhat larger and darker plate. Laterally the spots are arranged one directly above and one below the stigmata. Head rather small, only about one-half the general diameter, bright golden brown, with fuscous trophi. Cervical collar entirely covering dorsum of first segment, glossy, dark brown, especially on lateral margins, pale in medio-dorsal space. Legs pale gray-brown; pads of prolegs similarly colored, all very short. Anal shield small, rounded-triangular, clouded, pale brown.

One acorn seldom suffices for the nourishment of a larva, and it cuts its way out of the first and into the second of a cluster through the scales of the cups near the base where the acorns approach each other

most nearly, forming a tunnel of thick, dingy web between the two. In entering a second acorn it not infrequently intrudes upon a Balaninus larva, in which case the latter is literally, as well as figuratively, "forced to the wall." While the caterpillar appropriates to itself all of the remaining provision within the shell, it does not, to the best of my knowledge, include the Curculio larva in its feast, as I have frequently found the latter blackened and shrunken on one side of the coarse, dry, granular castings of the Lepidopter, which are but very slightly webbed. In emerging, when full grown, the larva almost invariably cuts its ragged-edged exit through the involucre as well as the shell of the nut, which Balaninus rarely, if ever, does. It then drops or spins down to the earth, where it forms for itself, against the base of the tree, a slight cocoon, outwardly disguised with bits of bark; or it constructs a nest, flattened, broad-oblong case from the contiguous surfaces of two leaves or of a folded leaf, almost, but seldom quite, severing the margin from the leaves. This case is firmly joined at the edges and slightly lined with silk, and within it the larva remains unchanged for from seven to nine months, transforming to pupa only about ten days before the moth appears. This protracted larval dormancy makes it a somewhat difficult insect to rear, as it must not be kept too dry nor have a superabundance of moisture. The pupa is of a golden-brown color with distinct dorsal sculpturing and spiny ridges, and upon giving forth the moth is protruded more than half way out of the case.

The perfect insect, which varies in wing expanse from 15 to 24^{mm}, is elegant in coloring, with an intermixture of dull red and grayish brown or cream colored scales—the lighter color predominating in some specimens, while the darker does in others. The especial ornamentation consists in three more or less interrupted coppery or bronzy metallic fasciæ; in an indistinct pattern of black streaks and dots near the outer margin of the primaries, and in the heavy, pale-gray fringe succeeding a narrow red marginal line. The under sides of the wings of both sexes have, in some lights, a peculiar metallic green shade. The male is usually one-third smaller than the female, and is most characteristic with his profusely tufted hind legs and feet. The hind-wings are very fragile and at the same time difficult to extend, so that it is by no means an easy task to set the insect without injury to its beauty.

From this species I have bred in small numbers two species of parasites, a *Cymodusa* sp.? and a small Tachinid, which, Dr. Riley informs me, is new to the collection of the National Museum.

CYNIPID GALLS IN ACORN.

In opening acorns of *Q. tinctoria* I have found from five to seven per cent infested by Cynipid larvæ of a species to which Dr. Riley, who has been familiar with them for many years, has given the MS. name *Callirhytis fruticola.* This tiny Hymenopteron converts the cotyledons of the fruit into a mass of small, white, oval cells, the walls of which are excessively hard. From twelve to twenty of these cells are often found

within a single nut and so consolidated that it is almost impossible to detach a cell entire.

I have no records of ever finding these galls in any acorns of other species than those of the Black Oak group, and with us they are mostly confined to the species above named. The winter is passed in the mature larva state which the insect apparently attains in a very brief period of time after the acorn had been stung. I have not yet been so fortunate as to obtain the fly, but Dr. Riley informs me that it was bred by Mr. H. G. Hubbard some years ago and has also been reared by himself.

THE ACORN MOTH.

The remaining species to be considered is the pretty little inquiline *Blastobasis glandulella* Riley, which was originally described under the popular name of the "Acorn Moth." Dr. Riley published his descriptions of the species in the *Canadian Entomologist* (vol. IV, p. 18) and in his Fourth Annual Report on the Insects of Missouri.

The larva is a very lively, slender, subcylindrical caterpillar of a translucent pinkish or yellowish-white color with broad, pale brown, corneous head and shield. It is to be found during winter in a very large proportion of the acorns vacated by Balaninus as well as in some of those first occupied by Melissopus. After hatching, its first energies seem to be devoted to closing the small circular orifice through which its predecessor made its exit and into which its Tineid parent had dropped the egg that produced it. It seems almost incredible that so tiny a larva could spin so much and so dense web as is required for this purpose. These larvæ, when found following Melissopus, do not seem to find, in the débris of the latter, as much or as palatable nutriment as that to which they were no doubt originally adapted, for they are, as a rule, small and retarded in development, and no doubt, in many cases, perish. In the castings and crumbs left by the Curculio, however, they find a rich feast which they appropriate but slowly, as the growing period lasts through the entire winter. Their own castings are webbed into a compact bundle wrapped in white silk on the surface of which they rest.

The transformations usually take place within the acorn, but in some instances the larva comes out and spins a tough, oval cocoon among a cluster of nuts or against a dry leaf or on the surface of the soil. The moths appear at intervals throughout the summer and may be taken in the net by sweeping the surface of the ground under oak trees. They are also somewhat attracted by lamplight and frequently enter rooms at night.

Of other insects that have been found in acorns may be mentioned several specimens of *Phycis* (*Canarsia*) *hammondi* Riley or a species closely allied to the latter, which emerged last spring from acorns in my rearing jars. The probability in this case is that the larvæ, which

are known to feed upon the leaves of oak, had merely, on completing their growth, entered the acorns for shelter while undergoing their transformations.

A small Carabid larva, not yet bred, is also occasionally found in the débris of other insects inside the acorn, and in one of the latter which I recently opened were a number of minute, salmon-colored Dipterous larvæ having the appearance of a Cecidomyiid.

These include all the acorn insects that I have found during the two or three years that I have had them more especially under observation, but no doubt, in other sections of the country, still other species occur so that the list is merely locally complete up to date.

PRELIMINARY REPORT ON SUPPRESSING THE SAN JOSÉ SCALE IN VIRGINIA.

By D. W. Coquillett.

The following is a brief account of an attempt recently made under instructions from Dr. Riley, to eradicate the San José Scale (*Aspidiotus perniciosus*) in the vicinity of Charlottesville, Va.

From examinations made it would appear that the area of infection is nearly in the form of a parallelogram, measuring 75 yards from east to west, and 350 yards from north to south. The trees upon which the pest was supposed to have first appeared are located nearly in the center of this area, and it is curious to note that while these insects have spread to a distance of about 175 yards, both north and south of the original source of infection, their distribution to the east or west has been only about one-fifth of this distance. This is the more singular, owing to the fact that these insects depend largely upon the winds to transport them from tree to tree, and in the present instance the direction of the prevailing winds is from west to east, occasionally changing to the northwest or southwest, but very seldom or never blowing from the north or south. This unequal distribution is not due to the lack of suitable plants, since in many places both east and west of the infested area are growing the same kinds of plants and trees as those already infested. It is, therefore, very singular that these insects should have spread five times as far in two directions as they have in the other two.

Having previously dispatched the apparatus and chemicals to be used in this work, I proceeded to Charlottesville on the morning of the 12th of March, and interviewed Dr. C. H. Hedges, the owner of the originally-infested trees, who drove me to the residence of Mr. H. L. Lyman, one of the members of the Virginia State Board of Agriculture. Mr. Lyman, in accordance with a resolution adopted by the Board, agreed to furnish a sufficient number of men to operate the tents during the process of treating the infested trees with hydrocy-

anic acid gas. Accordingly, on the morning of the 13th, the work of disinfection was commenced.

The tents used for the purpose of inclosing the infested trees are made of 8-ounce duck, oiled with linseed oil. They are in the form of octagonal sheets, and are four in number, two of them being 28 feet in diameter, while the other two measure 44 feet. These could be placed over the trees by hand, or by the use of poles when the trees did not exceed 10 feet in height, but on larger trees it was necessary to use a sort of tripod for the purpose of placing the tents over them. This apparatus consists of two pine scantlings, each two by three inches thick and twenty feet long, fastened together at the upper end by a bolt having a ring in place of a head. To this ring is attached the pulley through which passes the rope used in hoisting the tent. To the opposite or lower end of each of these scantlings is fastened a cross-piece of 6-inch pine board, one of the cross-pieces being 18 inches, the other 5 feet long, and having a brace extending from each end to the scantling, to which it is fastened at a point 5 feet from its base. These cross-pieces serve the purpose of keeping the tripod in an upright position, and in actual practice were found to be sufficient for this purpose.

When the tent is to be placed over a tree, it is spread out on one side of the tree and the tripod erected on the opposite side and as close to the base of the tree as it is possible to get it; one end of the five-sixteenths-inch rope passing through the pulley at the upper end of the tripod is furnished with a strong iron hook, which is next hooked into a loop attached to the tent, after which the opposite end of this rope is drawn downward until the tent is drawn to the top of the tripod; the foot of the latter is moved several feet farther from the tree and the tent again drawn over the tree until it will cover the latter, after which the tent is allowed to drop over the tree.

The chemicals used in generating the hydrocyanic acid gas consist of fused potassium cyanide of about 58 per cent purity, commercial sulphuric acid, and water, the proportions being 1 ounce by weight of the cyanide, a trifle over 1 fluid ounce of the acid, and 3 fluid ounces of water. This will be sufficient for 150 cubic feet of space inclosed by the tent; by computing the number of cubic feet thus inclosed and dividing this by 150 we obtain the quantity of cyanide in ounces and fractions that the tree will require, after which it will be comparatively easy to ascertain the quantity of each of the other ingredients required by bearing in mind that each ounce by weight of the cyanide will require slightly over a fluid ounce of the acid and 3 fluid ounces of water.

Almost any glazed earthenware vessel will answer the purpose of a generator. I used 1-quart pitchers; also an open vessel holding about 1 gallon, and a 2-gallon jar. The pitchers were large enough for using 2½ ounces or less of the cyanide, but when a somewhat larger quantity than this was used the action of the chemicals resulted in throwing a portion of them out of the pitcher, thereby occasioning a loss. On

the largest tree subjected to the gas I used 18 ounces of the cyanide and the other ingredients in their proper proportions, employing the 2-gallon jar for a generator, and this was large enough to contain the chemicals during the process of generating the gas.

Altogether, I treated 326 trees and shrubs with this gas; these are as follows: pear, 187; apple, 8; quince, 4; plum, 24; peach, 13; cherry, 22; gooseberry, 17; currant, 9; *Eleagnus longipes*, 5; rose, 25 and lilac, 12.

After the tent was placed on a tree and charged with the gas it was allowed to remain on the tree for half an hour. Four men could remove the four tents from the trees, place them over others, and charge them with gas in from fifteen to twenty minutes, according to the size of the trees. Six tents could easily have been operated by this number of men without any loss of time, since the tent first placed over a tree would be ready for removing by the time that the last tent was charged with the gas. This would result in treating twelve trees an hour, but in the case of small trees and shrubs several of these could be treated at a time by one of the tents.

The chemicals used in this work were furnished the Division by one of the druggists of this city—the potassium cyanide at 60 cents per pound and the sulphuric acid at 3½ cents per pound. It is worthy of note that the fruit-growers of Southern California obtain this same brand of cyanide (Powers and Weightman's 58 per cent fused) at 39 cents per pound, and that, too, after paying the freight on it almost across the continent. About 42 pounds of the cyanide and 90 pounds of the acid were used in treating the 326 trees and shrubs above mentioned. Assuming that the cyanide could be obtained at the same price that it can in California, that the four men could be employed at $1 per day, and that they could treat an average of twelve trees an hour, working ten hours a day, gives us the following as the probable cost of treating the 326 trees and shrubs mentioned above:

42 pounds cyanide, at 39 cents per pound	$16.38
90 pounds sulphuric acid, at 3½ cents per pound	3.15
4 men 2⅔ days, at $1 each per day	10.66
Total	$30.19

This is an average of slightly over 9 cents for each of the 326 trees and shrubs treated with the gas.

It was anticipated that considerable difficulty would be experienced in operating the tents on the leafless trees, which are so different from the Citrus trees, upon which this treatment has been principally performed in the past; but, with the exception of some large pear trees, the branches of which were more rigid and brittle than those of the other trees, but little trouble was experienced in this direction. It was found expedient to draw the tents off of the trees in the same direction that they were drawn on; any attempt at taking them off in an opposite direction is almost certain to result in the breaking of the branches.

NOTES FROM CORRESPONDENTS.

Icerya montserratensis in Colombia.—Dr. S. A. Davis, of New York City, has sent us a vial containing full grown females and newly hatched larvae of *Icerya montserratensis*, which he collected upon American rose bushes at Colon, Isthmus of Panama. He says that a friend tells him that the insect is abundant in the interior of Colombia. This interesting sending adds a new food-plant and a new locality for this beautiful species, which was first described in INSECT LIFE (vol. III, pp. 99–103).

Danais archippus in Chile.—Mr. Edwyn C. Reed writes us that he has reared this large cosmopolitan butterfly from the larva, in Chile. This point is of great interest, as Scudder states that the species is distributed in South America only east of the Andes and north of Rio, although it has recently been reported by Dr. Carlos Berg from Patagonia.

Kerosene against Mosquitoes.—Mr. John B. Lembert, of the Yosemite National Park, writes us that the miners in the Minaret mining district make a mixture of kerosene and mutton tallow, and smear their "burros" with this ointment. This gives the little animals perfect immunity from the mosquitoes, while without it their heads become simply a crust of dried blood on the outside, so abundant are mosquitoes and horse flies.

Two more Cases of Bots attacking Cats.—Mr. Walter H. Harrison, of Columbia County, N. Y., writes us that last summer he removed larvæ from the side of the eye and from the back of a cat belonging to his family. The specimens unfortunately were not saved. Mr. William Mansbridge, writing from St. Louis, states that one of a litter of six kittens was attacked, and when six weeks old a large bot three-fourths of an inch in length was found in the side of its neck.

The Azalea Scale in Michigan—Mr. G. C. Davis, of Agricultural College, Mich., sends us specimens of the somewhat rare and interesting *Eriococcus azaleæ* Comst., occurring upon Azalea plants at the Agricultural College. This insect has not yet been found out of doors, and it will be interesting to know its natural habitat.

Parasite of the Cynthia Silkworm.—We have just received further specimens of *Spilochalcis mariæ*, the well known American parasite of the larger native silkworms, from Mr. Townsend, Kingston, Jamaica. This parasite, as we have already shown, reached Jamaica by way of England, having probably been sent to some entomologist in the latter country for curiosity or experiment.

The "Sacred Silkworm of India" Hoax.—Some time ago in the Southwest, and particularly in New Orleans, eggs of the so-called "sacred silkworm of India" were offered for sale, with the statement that the larvæ would feed only on the castor-bean plant. We suspected dishonesty in this enterprise, but have only recently received specimens of the insect, the eggs of which were sold under these pretensions. It proves to be the common Polyphemus moth, which, as everyone knows, is an indigene of this country.

Scale-insects on Ivy.—Mr. T. D. A. Cockerell writes us that he is making a special study of the scale-insects affecting the ivy plant. Incidentally he announces that he suspects the old and well-known *Aspidiotus nerii*, so commonly found upon Ivy and Oleander in this country, to be synonymical with the *Aspidiotus hederæ* of Europe. We are not inclined to admit this synonymy as yet, but the possibility is interesting.

Wireworm in the Burrow of an Apple-tree Borer.—Mr. Barry C. Hawkins, of Horse Cove, N. C., sends us the larvæ of a click beetle of the genus Corymbites, which he took from the burrow of the common Round-headed Apple-tree Borer, *Saperda candida*. The entrance hole was near the ground, and the Corymbites larva had apparently destroyed the borer.

Persimmon Root-borer.—There is an interesting Sesiid moth, described by Mr. Ridings as *Phemonoe 5-caudata*, which we ascertained, some years ago, to feed in

the larval state in the roots of Persimmon in Florida. We have recently received larvæ of the same insect in the roots of persimmon saplings from Delaware, and during April the same thing came to us from our friend and correspondent, Mr. G. C. Brackett, Lawrence, Kans. The species therefore is widespread, and probably being still more widely spread by the recent traffic in persimmon nursery stock.

Box-elder Plant-bug in Houses.—Mr. William M. Freeman, of Dayton, Wash., has recently sent us specimens of *Leptocoris trivittatus,* with the statement that it occurs in numbers in his house. We have previously recorded instances of this kind. The insect feeds upon box-elder shade trees and hibernates in the adult stage, seeking the warmth and shelter of dwellings. We have heard unsubstantiated rumors that the insect will enter beds and bite human beings under these circumstances.

Cottonwood Scale insects.—Mr. Lawrence Bruner has found in Nebraska two scale-insects which injuriously affect the cottonwood tree. One of these is Comstock's *Chionaspis ortholobis,* and the other is a larger and undescribed species of the same genus.

Larvæ in a Child's Face.—Our note under this head published on page 270 of the last number of INSECT LIFE has attracted the attention of Prof. Raphael Blanchard, the eminent French naturalist, who is anxious to secure specimens. We have been unable to get any as yet. Prof. Blanchard has especially studied the subject of these Dipterous parasites of human beings, and has published several important papers on this topic. Readers of INSECT LIFE are requested to report any new cases which may come under their observation.

Clover-leaf Beetle in Maryland.—A great abundance of *Phytonomus punctatus* around Washington has been noticed for some years past. The fungus disease which has carried off the larvæ of these beetles in such great numbers in New York and Pennsylvania has also been observed in this vicinity. We have recently received specimens from western Maryland, with the information that the insect is doing great damage to the clover crop this spring. The fungus disease has not been noticed in the locality. This case is so serious that the plowing under of the crop has been advised.

Galls on the Roots of Poison Ivy.—Mr. Walter H. Harrison, of Lebanon Springs, N. Y., sends us some small oval fleshy galls found on the roots of *Rhus toxicodendron,* which are evidently the work of a Cecidomyiid larva. The species is new to the National Museum collection and the adult is not known.

Early Appearance of Benacus griseus.—Mr. C. F. Stamm, of Chestertown, Md., sends us an active specimen of the Giant Water-bug (*Benacus griseus*) which was captured at Chestertown on the 26th of March.

A Walnut Scale on Pear.—Prof. H. A. Morgan, of Baton Rouge, La., has made an interesting find. The English Walnut Scale (*Aspidiotus juglans-regiæ*) described by Comstock in the Annual Report of this Department for 1880 (p. 300), from specimens found on an English walnut tree at Los Angeles, Cal., is found by Prof. Morgan to occur in numbers upon pear trees near Baton Rouge. This is another of the scale-insects of very considerable economic importance, the original home and spread of which have not been successfully studied, although it is probably an American species.

GENERAL NOTES.

NEW JERSEY'S PROPOSED LEGISLATION AGAINST INSECTS.

In the department of Economic Entomology of *Entomological News* for February, 1894, Prof. John B. Smith discusses the subject of legislation against insects, and gives the text of a law drafted by a com-

mittee of the State Horticultural Society to prevent depredations by insects injurious to the agricultural and horticultural interests of the State, which is to be submitted to the legislature of the State at the present session by the legislative committee of the State Board of Agriculture. The act provides tnat whenever requested by a resolution of any county Board of Agriculture the Executive Committee of the State Board of Agriculture shall appoint three persons to act as commissioners for the purposes of the act, such commissioners to be paid a reasonable allowance out of the fines and costs collected under the further provisions of the act. When complaint is made to such commissioners that any agriculturist has neglected or refused to employ the methods prescribed by the State Agricultural Experiment Station for the destruction of injurious insects notice shall be served in writing upon such person, specifying the insect or insects complained of, and said notice shall be accompanied by a reference to the reports of the Experiment Station where the proper remedy is prescribed, or a printed copy of the proper bulletin or report may be served with the notice. It shall be the duty of the person so notified, within twenty-four hours, to proceed to destroy the insects complained of on his lands in the manner prescribed; and failure to do so within six days after receipt of notice shall render him liable to a fine of not less than twenty-five nor more than one hundred dollars, in the discretion of the Court. The act to take effect immediately upon its passage.

Of the committee which drafted this act Professor Smith was himself a member, and while admitting the justice of the proposition that the careful agriculturist, who exerts himself to keep down insect pests, should not be handicapped by the negligence of his neighbors in this respect, he is convinced that it will be almost impossible to enforce any law on the subject, the sentiment against informers rendering it extremely difficult to secure convictions on their testimony. The act as drafted, however, is to be called into effect only through the action of the County and State Boards of Agriculture, thus throwing the burden of enforcing it upon the official organization of the farmers, and, as Professor Smith remarks, where there is sufficient public sentiment to secure its enforcement such a law will not be a dead letter.

INSECT LEGISLATION IN AUSTRALIA.

The fruit-growers in Victoria, in spite of their strenuous efforts in favor of the noxious insect bill were unable to secure its passage through the last Parliament, which dissolved without giving such a bill consideration.

LEGISLATION AGAINST INSECTS IN MASSACHUSETTS.

On another page we have noticed the proposed legislation against injurious insects in the State of New Jersey. Similar but less stringent measures were some time ago adopted by the Commonwealth of Massa-

chusetts to protect the orchard and shade trees, that are properly cared for by their owners, from insect pests which are permitted to breed unrestricted in public highways and waste places.

The act in full is reprinted herewith:

AN ACT to provide for the Extermination of Insect Pests.

Be it enacted, etc., as follows:

CHAP. 78, SECTION 1. Cities and towns shall raise annually by taxation and appropriate such a sum of money as they may deem necessary, to be expended under the direction of the mayor and aldermen in cities and the selectmen in towns, in exterminating insect pests within the limits of the highways in their respective cities and towns, and in the removal from said highways of all trees and shrubs upon which such pests naturally breed: *Provided, however,* That where the owner or lessee of real estate abutting on the highway shall annually exterminate all insect pests from the trees and shrubs along the highway where said real estate abuts thereon, such trees and shrubs shall be exempt from the provisions of this act.

SECTION 2. This act shall take effect in any city when accepted by the city council, and in any town when accepted at a legal town meeting called for that purpose. [Approved March 9, 1893.]

THE INSECTS SUBJECT TO PARASITISM.

On page 201 of the current volume is printed a paper by Mr. C. H. Tyler Townsend, entitled "Dipterous Parasites in their relation to Economic Entomology," which, although reaching the secretary of the Association of Economic Entomologists too late for presentation at the meeting, was submitted by him for publication in INSECT LIFE, together with the rest of the official minutes. As a part of these minutes it was published in this periodical, but a somewhat serious misstatement occurs in the second paragraph, to which it is worth while to call attention. Inasmuch as no general notes were published in that number, this statement is properly made at this time. Mr. Townsend says:

Of the sixteen orders of insects, as evolved by Brauer and now generally accepted, only five are subject to parasitism. These are the Orthoptera, Hemiptera, Coleoptera, Lepidoptera, and Hymenoptera. * * * The Hymenoptera attack the last four, including their own order. The Diptera, however, furnish parasites upon all five of these orders.

We wrote to Mr. Townsend concerning this error and he replied that it occurred through the fact that his library had not yet followed him to Kingston from Las Cruces, and that he was, therefore, obliged to generalize from memory. He requested us, however, to make the proper correction. As a matter of fact, certain of the Diptera themselves, the Neuroptera, the Odonata (egg state only), and the Platyptera are parasitized as well as the five orders mentioned by Mr. Townsend. Thus, the number of orders subject to parasitism is nearly doubled. Instances of the parasitism of insects of the four orders which we have added will occur to most entomologists. It will be noticed that Mr. Townsend also excludes the Orthoptera from the Hymenopterous parasitism, whereas the well known occurrence of Eupelmus in the eggs of katydids and of

other Hymenoptera in cockroach egg-cases, as well as the occurrences of both Chalcidids and Proctotrypids in the eggs of certain crickets, to say nothing of the fact that the large genus Scelio lives exclusively, so far as we know, in the egg-pods of Acridiidæ, should have been remembered.

Mr. Townsend's misstatement has met the critical eye of M. A. Giard, of Paris, who has written us, giving a number of known instances of parasitism in Diptera and Neuroptera. He also remarks that Mr. Townsend has overlooked the recently discovered parasitism of Homoptera by Elenchus. The subject of Parasitism in Insects was chosen for the annual address of the president of the Entomological Society of Washington for the year 1892, and was uppermost in our mind at the time, but we did not notice the above oversights, because they were in official minutes.

COLORADO INSECTS.

Under the title "Entomology of the Mid-Alpine Zone of Custer County, Colorado," Mr. T. D. A. Cockerell brings together the results of his somewhat extensive collecting during his residence in Colorado some years ago. He catalogues about a thousand species, which, although it may seem a small number to those who have collected only in regions of lower elevation, is probably fairly representative of at least the character of the insect fauna of the region described, which extends from 6,500 feet to 10,000 feet. It is essentially a zone of oak scrub and quaking aspen. The characteristic plants, birds, and mollusks of the region are mentioned briefly. The Coleopterous fauna is largely boreal, with a slight southern element and a fair number of species endemic in the Rocky Mountains. The butterflies are boreal, with a strong western element. The author discusses the question of zoological regions, particularly in reference to the system adopted by Dr. C. Hart Merriam, and briefly touches upon many interesting topics, such as the origin of the Rocky Mountain fauna, the fossil insects of Colorado, the glacial epoch, remnants of the ancient fauna, post-glacial development, and species-forming areas. The data are probably insufficient for so comprehensive a summing up, but the paper is interesting and suggestive, and the list will form a basis upon which Colorado entomologists may work.

LONDON ENTOMOLOGICAL AND NATURAL HISTORY SOCIETY.

The Transactions of the London Entomological and Natural History Society for 1893 has recently been issued in a pamphlet of some eighty pages of closely printed matter. It includes reports of the meetings of the Society from December 20, 1892, to December 5, 1893, together with abstracts of the papers read and an appendix consisting of papers presented up to March 16, 1893. The following is a list of the more important articles: Specific nomenclature, present, past, and future, by

Dr. F. J. Buckell; Melanchroism in British Lepidoptera, by J. W. Tutt; The history of butterfly classification, by Dr. Buckell; Is moisture the cause of melanism, by J. E. Robson; Notes on certain coleopterous insects found in city warehouses, by G. A. Lewcock; The Genus Silpha, Linné, by W. F. Johnson and G. A. Lewcock. All of the above papers are of considerable general interest, particularly to Lepidopterists and Coleopterists; the article on Coleoptera found in city warehouses is, however, of special importance, as it bears on the habits of several species that have become introduced in this country by commerce. Of those receiving special mention *Dermestes lardarius*, *Sitodrepa* (*Anobium*) *panicea* and *Ptinus fur* are well-known injurious species, while a considerable portion of the others occur here.

ENTOMOLOGICAL MATERIA MEDICA.

Persons interested in this subject will find a very good compilation of the insects used in medicine in a paper by Richard Ernest Kunze, M. D., of New York, read at the World's Medical Congress, June 2, 1893. The paper is sent to us as a pamphlet issued by the author, and we are unable to give any further facts concerning its publication. The entomology of the work is rather weak, old names being given throughout and many of these misspelled, but this is by no means a serious blemish, and the paper brings together many interesting facts.

LE NATURALISTE CANADIEN.

Since the death of that learned and hard-working entomologist, the Abbé Provancher, the publication of *Le Naturaliste Canadien* has been interrupted. We are glad to receive the first number of volume XXI, published January, 1894, as an evidence that the journal has been revived. The editor and proprietor is, as was our lamented friend and correspondent, a Catholic priest, the Abbé V. A. Huard, who is also, fortunately for our science, an entomologist. He announces in this number, however, that while the journal will occupy itself especially with entomology, other departments will be represented.

A NEW CANADIAN JOURNAL.

We have just received a copy of the first number of the first volume of the *Biological Review of Ontario*, a neat little journal published at Toronto. The contents are mainly ornithological, but the first number contains an article by our friend and correspondent, Dr. William Brodie, on "Canadian Galls and their Occupants," which seems to be introductory to a series to be published under this title. The present installment contains an account of *Diplosis erigeroni* n. sp., giving Dr. Brodie's field and rearing notes on an interesting new gall, which he finds on *Erigeron canadense*, variously situated from the base of the stem to the tips of the branches of the flowering panicle. The galls are

irregularly cylindrical, tapering at both ends, and those on the branches are more or less spherical. A second article, by George Brodie and W. A. Brodie, records the occurence in great numbers of the common Red-legged Locust, *Caloptenus femur-rubrum*, during the summer of 1893 in the middle and eastern counties of Ontario. Many thousands of dollars worth of farm products were destroyed over the infested area.

INSECT INJURIES IN NOVA SCOTIA.

We learn from the annual report of the Secretary of Agriculture of Nova Scotia for 1893 that damage by the Colorado Potato Beetle has grown less, but that considerable damage has been done to various crops by locusts, while perhaps the most serious insect depredations of the season have been accomplished by the Bud Moth (*Tmetocera ocellana*), although the species is not identified. In certain localities one-third of the apple crop was destroyed by this species, the crop of Nonpareils being almost entirely lost.

INSECTS OF ALDABRA, ASSUMPTION, AND GLORIOSO ISLANDS, INDIAN OCEAN.

In a short paper published as No. 973 of the Proceedings of the U. S. National Museum, Dr. W. L. Abbott gives a brief report on the natural history of these islands, in which is included a list of the insects. The species, as a general thing, are those of south and east Africa. The Museum has received other collections also made by Dr. Abbott, from the Seychelles Islands and from east Africa, the largest amount of material having been taken in the interesting Kilimanjaro region. This material is being slowly worked up by specialists, and the reports when completed will form an important contribution to the geographical distribution of insects.

INSECT PESTS OF QUEENSLAND.

The Department of Agriculture at Brisbane has published as Bulletin 25 a report of the agricultural conferences held at Beenleigh, Bundaberg, Rockhampton, and Mackay. Among the interesting discussions which were held at these conferences, and which are reported with great fulness in this bulletin, we notice an important paper upon insect pests by Mr. R. E. Turner, which was read at the Mackay conference. Mr. Turner treats at considerable length the insect enemies of the sugar-cane in Queensland, and considers that the decrease of the native insectivorous birds, owing to their indiscriminate destruction by the Kanakas employed on the plantations, has a great deal to do with the increase of sugar-cane insects, particularly white grubs, which have of late been so abundant. These people, it seems, spend their Sundays destroying the birds. The borer moth, Mr. Turner thinks, may be identical with *Diatræa sacchari* but is certainly distinct from *Proceras*

sacchariphagus, which is the most serious cane pest of Mauritius. The insect enemies of Citrus fruits are considered at some length. With the scale-insects we are already familiar through the reports of Mr. Koebele's trips to Australia, as well as the reports of Messrs. Tryon and French. Outside of scale-insects, however, oranges are damaged in Queensland by the larva of *Papilio erectheus*, which works in the same manner as the congeneric "orange dog" of Florida. Queensland possesses a new type of orange insect, however, in the shape of several species of Noctuid moths, of which *Ophideres fullonica* is the most prominent, and which ruin the fruit by inserting their haustella and sucking the juices in just the same way that the Cotton Moth damages figs in our Southern States.

COFFEE INSECTS IN HAWAII.

In the *Planters' Monthly* for December, 1893, published at Honolulu, Mr. William G. Wait gives an interesting summary, upon pages 559–562, of the insects which he has found affecting the Coffee-tree in the Hawaiian Islands. The insects considered are all scale-insects and comprise *Dactylopius destructor*, *Pulvinaria camellicola*, and an undetermined species of Lecanium. The author has found *Coccinella abdominalis* and a species of Scymnus breeding upon the Dactylopius and *Coccophagus hawaiiensis* How. MSS., and *Dilophogaster californica* parasitizing the other two species. A smut fungus (*Capnodium lanosum*) follows the scale-insects and does more damage to the plant. The fungus is eaten by a species of Psocus, colonies of which live in gauze tents on the under surface of the leaves.

ABUNDANCE OF WASPS IN SOUTH BRITAIN.

In *The Entomologist* for January, 1894, Mr. W. Harcourt Bath records that in every part of south Britain visited by him, wasps have swarmed in countless numbers during the past season, in some districts doing great damage to the fruit crops. He attributes the abundance of the swarms to the dry weather of the preceding spring.

AN UNNECESSARY CASE OF PROTECTIVE RESEMBLANCE.

Mr. John T. Carrington, in *Science Gossip* for March, 1894, in an interesting little article upon roosting butterflies, brings out a number of interesting cases in which butterflies, in choosing their "roosting places" select locations in which they will be protected by their resemblance to their surroundings or to the object upon which they roost. Curiously enough, he republishes from INSECT LIFE the figure of *Anosia plexippus* published upon page 206 of volume v, in which the butterflies are roosting in numbers upon a dead twig. Here, says Mr. Carrington, resemblance to a twig covered with dead leaves is plainly aimed at, and this resemblance is protective. To a person giving a

casual glance at the figure this seems very apt, but when we remember that this particular butterfly needs no protection; that it is one of the markedly distasteful species; and that it is mimicked by other butterflies in different parts of the world on account of the fact that it is so distasteful—we see at once that it needs no protective resemblance, and that therefore Mr. Carrington's idea is quite fanciful. In settling in vast numbers upon a branch these butterflies could not well take any other positions and be at peace with each other.

ON THE LARVA OF EPHESTIA KUEHNIELLA.

Apropos of our review on p. 44 of the current volume of INSECT LIFE of Mr. Danysz' paper concerning the embryonic testicle of the larva of *Ephestia kuehniella*, M. A. Giard calls our attention to Mr. E. B. Poulton's paper in the Transactions of the Entomological Society of London, for 1888, in which the same facts are virtually given. For the moment we had overlooked the fact that this discovery had previously been made by Mr. Poulton.

PARASITE OF THE JAPANESE GYPSY MOTH.

Last November we received from the Rev. H. Loomis, of Yokohama, a small box containing cocoons of a Microgaster parasitic upon *Ocneria japonica*, which, it will be remembered, we are trying to introduce for use against the Gypsy Moth in New England. Upon examination it was found that the majority of the cocoons were empty, and a large proportion had been infested with a secondary parasite of the subfamily Pteromalinæ.

THE EFFECT OF LOW TEMPERATURE UPON SILKWORM EGGS.

In the January, 1894, issue of *Le Naturaliste*, M. Henri Coupin reviews the experiments of M. Pictet, of Geneva, on the influence of low temperatures upon animals. Among the curious observations made by M. Pictet, those upon the living eggs of silkworms have a peculiar interest from the fact that a practical result of some importance was unexpectedly arrived at.

It was found that silkworm eggs could be subjected to a temperature of —40° (presumably Centigrade) without endangering their development, and that when the refrigerated eggs were taken out of the cold chamber and subjected to normal conditions of temperature at the time of the leafing of the mulberry trees, they hatched with almost no risk of attack by the maladies which are so common to silkworm eggs that have been left to themselves and have endured several months of fluctuating temperature. In other words, the parasites of the eggs do not, under conditions of low temperature, find themselves in a situation favorable to their growth, and the worms issue practically insured against the risks so formidable to them and to the silk industry.

FURTHER FACTS ON ERASTRIA SCITULA.

Through the kindness of M. A. Giard we have been made acquainted with the interesting observations of Capitaine Xambeu, of Ria, Pyrenées Orientales, upon this predaceous Lepidopteron, an account of which was published in *Le Naturaliste* for August 15, 1891. M. Xambeu gives a very careful account of the life-history of the insect, agreeing in nearly all respects with that made out independently by Dr. H. Rouzaud, which we have recited at some length in No. 1 of the current volume of INSECT LIFE. We promised an attempt at an introduction of this insect into the olive-growing regions of California at the earliest possible moment. Unfortunately Dr. Rouzaud's duties as member of the Chamber of Deputies at Paris have prevented him from attempting the sending of living specimens of this important beneficial insect to this country; and further he writes us that during 1893 the species has been extremely scarce at Montpellier. Inasmuch, however, as Capt. Xambeu reports it as very abundant at Ria, we have written him in the hope that he will be able to send living specimens in the hibernating condition before the winter season is passed. We have little hope of being able to introduce the species except during the winter.

A STRIKING INSTANCE OF RETARDED DEVELOPMENT.

On September 20, 1893, Mr. Albert Koebele wrote us from Alameda, Cal., to the effect that while engaged some two weeks previously in cutting up some of the Yucca stems which he had collected in Los Angeles County May 17, 1887, two fresh and healthy larvæ of Prodoxus were found still present, spun up. There were large numbers of other larvæ that had died. The living ones will not issue before the coming spring, which will make them seven years old. We have called attention in our writings on the Prodoxidæ, to the tendency to retardation in development, but the period of latency experienced by Mr. Koebele is the longest so far recorded.

AN UNUSUAL EXPERIENCE WITH CABINET BEETLES.

An Iowa correspondent, Dr. J. M. Shaffer, writes us, under date of March 14, of a very unusual experience with the common Cabinet Beetle (*Anthrenus varius*). Three years ago he had twenty cases of insects destroyed by this species in spite of treatment with camphor, chloroform, and benzine. Boxes, insects, and all were saturated with benzine, but without producing satisfactory results. An Acridium, he writes, was captured and mounted in October, and placed in a drawer with other insects. A few days later the grasshopper was discovered half eaten, and, on being broken open, found to contain Anthrenus larvæ. The only explanation that we are able to give without personally visiting the premises is that the building in which the insect collection is kept, and which Dr. Shaffer informs us also harbors other collections of

natural history, is overrun with the little pests, and as fast as the insecticides used in the boxes evaporate other individuals of Anthrenus replace such as have been killed. A thorough search in such cases might reveal a box of neglected specimens somewhere in which the Anthrenus are breeding. Our correspondent was advised to subject the room in which his collection is stored to a thorough fumigation with bisulphide of carbon or benzine, to be repeated in a month or six weeks later and again in the summer, if these two applications were not thoroughly successful.

INSECT DAMAGE TO BEER-CASKS IN INDIA.

We have just received from the author, Mr. Walter F. H. Blandford, a most thorough and interesting report on the destruction of beer-casks in India by the attacks of a boring beetle (*Xyleborus perforans*). We have, in one of the earlier numbers of INSECT LIFE, incidentally mentioned this peculiar damage which has for many years been a source of trouble to the officers in the Commissariat Service of the Government of India. Burrows or tunnels are excavated from the outside of the cask-wood and run in various directions in its interior, a certain proportion of them being continued through the wood so as to cause leakage and subsequent souring of the beer which remains. These attacks have been known certainly since 1850, and there has been considerable controversy as to whether they originate in England or are brought about after the arrival of the casks in India. In general the officials in India have been looking to England for the remedy, whereas, as Mr. Blandford shows, the damage originates after arrival in the East, and remedial work should have been done there. The paper includes a full summary of previous reports on the subject; an account of the source of information of the author; the zoölogy of the borer; its habits in its different stages; its geographical distribution; a somewhat general consideration of the insects found in Oak timber; the circumstances influencing the attack in India, such as the construction of the go-downs or store-houses; the commencement of the attack during inland transit of casks; quality of the cask-wood; time of storage, and the extent of the damage. He shows conclusively that all attacks on casks have begun in India and not in Europe nor in any recorded instance on shipboard. The perfect insect bores into the cask and lays its eggs in the burrow. It attacks the wood and selects the moister part around the bung. Casks of thin wood suffer most. As a rule the inner surface is not reached. The insect permanently infests the store-houses and go-downs and is most injurious in those structures in which jungle-wood and bamboos are used. The author recommends the construction of casks out of thicker staves and hoops and the use of cask-enamel to keep the wood drier. As a protection for uninjured casks a large number of substances are mentioned, but thorough experiments do not seem to have been made. Treatment with quassia. lime, or creosote are those from which the best results are to be expected,

Suggestions for the construction of store-houses and particularly of wood from which they should be built are made. Teak-wood is recommended and bamboo should be avoided.

WORK OF THE GYPSY MOTH COMMISSION IN 1893.

The report of the Massachusetts State Board of Agriculture on the work of extermination of the Gypsy Moth for 1893 has just been received. It comprises the report of the committee of the Board in charge of the work, the report of the director of field work, and the report of the entomological adviser, Prof. C. H. Fernald. The legislature of Massachusetts appropriated $100,000 for the campaign against this insect in 1893, which, with about $5,000 left from the appropriation of the previous year, gave a fund of $105,000 for the year's work. Of this sum $75,927.46 was expended, the largest items being $56,874.33 for wages of men and $10,047.78 for supplies, tools, and insecticides. For the year 1894 an appropriation of $165,000 is asked. These figures indicate the extent of the task which the State of Massachusetts has to perform, and the importance of performing it successfully is shown by Prof. Fernald's estimate of $1,000,000 as the probable annual damage which the Gypsy Moth would do in Massachusetts alone if allowed to spread.

The work has been directed mainly toward checking the spread of the insect over adjacent territory. In this the committee and its director of field work, Mr. E. H. Forbush, seem to have been fairly successful, a list of ten places being given from which the insect has apparently been exterminated, while a large number of near-by towns in Massachusetts, Maine, and New Hampshire have been carefully inspected.

It is contended that the work still to be done demands even larger appropriations, and the list of towns still infested by the insect includes the city of Boston and twenty-one of the smaller suburban towns immediately around it. Some 12,000 acres of woodland are comprised within this territory.

Spraying with arsenicals, according to Mr. Forbush's report, was only partially effective, and such was the prejudice prevailing against this method in some of the infested towns that people frequently washed the trees and shrubbery with water from the garden hose, and so neutralized the effect of the spraying. Banding the trees with insect lime was also not thoroughly effective in preventing the caterpillars from ascending the trees, and while burlap bands afforded a means of assembling the insects, so that they could be easily killed, this method of trapping is completely successful only when the bands are visited every day—an impossibility with the means at command over so large a territory. Two means accomplished the object sought whenever they could be thoroughly applied. Fire can be used to destroy the eggs of the moth, to kill the caterpillars, or to starve them

by burning all near-by vegetation on which they feed; but this method is feasible only on waste lands. "A thorough, scientifically conducted search for and destruction of eggs, supplemented by burlapping and hand-killing, is the only method yet known that can be implicitly relied upon to secure extermination where fire can not be used."

Mr. Forbush is of the opinion that "If all trees and plants in and near each isolated moth colony could be sprayed with an insecticide which would surely and quickly kill all feeding caterpillars without injury to the foliage it would be the best plan to pursue in the towns least infested. Such an insecticide seems to have been found." This is presumably the mixture referred to upon page 20 of the report as "an arsenite with acetate of lead and glucose in water," the formula being: Sodic arseniate, 29.93 per cent; plumbic acetate, 70.07 per cent. This mixture, it is stated, has given the best results yet obtained by spraying.

Professor Fernald's portion of the report is brief, and consists chiefly of quotations from Professors Packard, Weed, Fernald, Smith, and Lintner commendatory of the work done by the committee. Two more parasites, *Pimpla pedalis* and *P. tenuicornis*, the first omitted from the list of last year and the second bred from the Gypsy Moth this year (1893), are added to the previously known parasites, making eleven true parasites which live within the caterpillar, but which do not emerge until after it changes to a pupa and is dead.

THE MEMBRACIDÆ OF NORTH AMERICA.

In the Bulletin of the Illinois State Laboratory of Natural History, current volume (pp. 391–482), Dr. F. W. Goding publishes a bibliographical and synonymical catalogue of the described Membracidæ of North America. The catalogue is well arranged and well printed. Localities are given with care, but food-plants are omitted except in a very few cases. The author introduces somewhat of an innovation by describing new forms in their catalogue position. In this way he prints descriptions of two new genera and sixteen new species. There are catalogued altogether 278 species, distributed among 65 genera. We are pleased to see the check-list idea giving way before these bibliographical and synonymical catalogues in comparatively new groups. The extra labor involved on the part of the compiler is much more than compensated for by the usefulness of the completed work. A thoroughly careful catalogue of this sort implies extended systematic work and indicates the near appearance of a monograph.

THE CACAO BUG OF JAVA.

We have recently received from Mr. A. King, manager of the cacao estate "Aardenburg," Java, owned by Mr. P. Maclaine Pont, of The Hague, specimens of an insect which does much harm to cacao, tea, and

cinchona in Java and Ceylon. Mr. King states that the adult insects fly and touch nearly every branch of a tree, after which the branches turn black, wither, dry up, and fall off. It is his opinion that the insects lay their eggs in the branches and multiply there. Their offspring are little brown insects which do not fly, but mostly injure the fruit. All efforts to destroy them have failed. The insect proves to be *Heliopeltis bradyi* Waterhouse, but careful examination of the branches, leaves, and fruit-husks failed to show any trace of the egg. Eggs were, however, taken from the body of one of the females and were very slender, about 1.4^{mm} long by 0.2^{mm} in diameter, and having a threadlike appendage of about 0.6^{mm} in length. According to the observations of Mr. J. Wood-Mason, of Calcutta, published in 1884, the eggs of *H. theivora* are laid singly in the substance of the tenderest shoots of the tea plant, in the internodes or portions of the stem between the pepoe and the two or three leaves succeeding from above downwards, and in the buds developed in the axils of the plucked leaves and in the parts thereto; that the presence and position of each egg is from the first indicated on the exterior by two unequally long glistening, bristle-like prolongations of the shell and later by discoloration of the pierced point. While the blasting of the tender twigs so characteristic of the work of this insect is largely accomplished by this process of egg-laying, it is also brought about by the puncturing of the stem by the beak of the insect in the process of obtaining food. Therefore the mere fact that the twig is blasted does not necessarily mean that it contains eggs, and at the wrong time of the season much labor might be wasted by the plucking and burning of the blasted twigs, as recommended by Mr. Wood-Mason and one or two other Ceylonese and Indian writers. The point is to ascertain the time of year (if there is a definite and restricted time of the year) when oviposition normally takes place. If the plantation is small, hand-picking of blasted twigs might accomplish some result. A much better plan, in our opinion, however, will be to await the hatching of the bulk of the eggs and at that time to apply a kerosene emulsion spray in order to kill the young bugs before they have acquired wings.

BED-BUGS AND RED ANTS.

It will be remembered that in our article on this subject in volume II of INSECT LIFE we explained the propriety of considering these two insects together, on the ground that the red ant nuisance is mitigated by the fact that these insects kill bed-bugs. We had never seen this statement in print before, and are consequently pleased to see published testimony of the fact from Mr. F. C. M. Boggess in the *Farmer and Fruit Grower* (Florida) for February 10. The habit is so well known to Mr. Boggess that he heartily recommends the introduction of red ants into houses for the purpose of exterminating bed-bugs. He advises the owners of infested establishments to place a piece of meat in an

old tin can, and bury it in the ants' nest, afterward taking it into the house and placing it beside the bed. Then he recommends that a bug or two be hunted up and placed in the can in order, as it were, to rouse a slumbering appetite for bugs in the ants. After that, he remarks, there is great satisfaction and much sport in seeing the ants run the bugs down and dismember them.

NORTHWARD RANGE OF THE WHEEL BUG.

Through the kindness of Mr. W. B. Sargent, of New York, we have received two specimens of *Prionidus cristatus* which were taken on the stone wall of Sleepy Hollow Cemetery at Tarrytown-on-the-Hudson, N. Y. This is most northerly point from which we have received this insect and we shall be glad to hear from readers who have found it farther north.

NORTH AMERICAN TRYPETIDÆ.

Mr. William A. Snow, in the *Kansas University Quarterly* (vol. II, No. 3, 1894), publishes a careful paper upon the Trypetidæ in the Museum of the University of Kansas. He gives descriptive notes indicating variations among the described species and characterizes 14 new species and two new genera. Two excellent plates showing wing characters of twenty-four forms are given.

THE ORANGE FLY IN MALTA.

In our article on the Morelos Orange Fruit-worm, in INSECT LIFE, (vol. I, p. 45,) and that on a Peach Pest in Bermuda (vol. III, p. 5), we have referred to the damage done in Mediterranean countries to Citrus and other fruits by *Ceratitis capitata*. In the December (1893) number of the *Mediterranean Naturalist* there is a short review of a pamphlet published in the Maltese dialect by Prof. N. Tagliaferro, at the expense of the Agricultural Society of Malta, and which gives a popular exposition of the life and habits of the insect and some consideration of the available remedies. He insists on the necessity of the gathering of all rotten fruit which has fallen to the ground, and proposes a means of his own discovery for considerably diminishing the damage. In October he smears with honey a few oranges on each tree. The adult flies gathered quickly around the honey and were readily captured. This remedy will be of some use where a few trees are to be protected and suggests the advisability of experimentation on a large scale.

LOCUSTS AND COCKROACHES OF INDIANA.

Mr. W. S. Blatchley has favored us with an important paper entitled "The Locustidæ and Blattidæ of Indiana," extracted from the Proceedings of the Indiana Academy of Sciences for 1892. These groups have been but little studied in the United States, and the consideration

of ever local fauna will be of value in many parts of the country. In the Locustidæ Mr. Blatchley describes 39 species, and his descriptions are so full and careful that by their use identification will be easy. He follows with the record of 12 species whose distribution is such that they will probably be found in future in Indiana. Under the head of the Blattidæ he describes with equal care seven species, five of which are indigenous.

CATALOGUE OF THE DRAGON-FLIES.

Mr. P. P. Calvert's Odonata of the Vicinity of Philadelphia, with an introduction on the study of this group of insects, extracted from the Transactions of the American Entomological Society (vol. XX, pp. 150 a–272), is a pamphlet which should be in the hands of all general collectors of insects. The handsome and interesting group of Dragon-flies has been neglected by students of American entomology, largely for the reason that such a publication has been lacking. The paper is evidently prepared with great care.

LIFE-HISTORY OF THE CHICKEN DERMANYSSUS.

An inquiry from Prof. F. L. Washburn, Entomologist to the State Experiment Station, Corvallis, Oreg., has reminded us that the life history of *Dermanyssus gallinæ* is not well known. This species is now comparatively common in certain sections of this country and its life affords a field for investigation.

Its larva is hexapodous. The adult mite is egg-shaped, posterior end largest, and is slightly flattened; the abdomen is margined with short bristles; the color varies from yellowish to dark red, depending on whether it is in a fasting condition or charged with blood. The oviparous female is $.70^{mm}$ long by $.40^{mm}$ broad. The male is $.60^{mm}$ by $.32^{mm}$. It infests domestic birds, poultry, etc., and also wild birds which nest about barns and outhouses, such as swallows. When abundant it also attacks horses and other mammals, producing a sort of scabies. A peculiarity of the habits of this insect is that its attacks are always temporary, or practically so, in that it abandons its host during the daytime and conceals itself about the premises in which the animals are kept. In the case of poultry it collects in colonies of males, females, and nymphs on the roosts, and frequently in the case of horses remains in the blankets or about the stalls. In poultry the attacks are severe and result in consumption and death. The mite is very prolific, multiplying quickly, although the exact period is not mentioned. The remedies consist in the removal of all poultry from stables and barns and the destruction of all nests of swallows, pigeons, etc. The treatment of poultry houses consists in the application of oils or other well-known insecticides adapted for such purposes.

AMERICAN TERTIARY APHIDIDÆ.

Mr. S. H. Scudder has sent to his correspondents, as an extract from the thirteenth annual report of the U. S. Geological Survey, a pamphlet comprising some account of the Tertiary Aphididæ of North America. It is astonishing that these soft-bodied and delicate-winged insects should be preserved in the rocks, yet Mr. Scudder has seen, from the Florissant beds alone, 107 specimens. The American forms comprise 32 species, divided into 15 genera, while in Europe but 19 nominal species are known. There seems to be an extraordinary variation in the wing-neuration of these fossil species, which necessitates a large number of genera. Most of them fall into the sub-family Aphidinæ, only a few of them being placed in the Schizoneurinæ. The genera and species receive treatment by means of synoptical tables, and bibliographical references are given, many of the forms being shown in careful plates illustrating the fossils exactly as found and also reconstructions of the wings.

THE CARNATION TWITTER.

In response to our inquiry requesting information about this disease of the Carnation, published on page 45 of the current volume of INSECT LIFE, Mr. William Falconer, editor of *Gardening*, writes us that the insect which troubled Mrs. Thaxter's plants is plainly not the one which produces the condition known as "twitter" and concerning which we quoted an item from Peter Henderson's late handbook. Twitters, says Mr. Falconer, is caused by what is probably a true Thrips. The most active ones are yellow and the more mature ones, apparently, are black. Tobacco smoke, he says, will kill them, but the plants must be brought into the greenhouse or into a pit to be fumigated, and the fumigation will have to be repeated several evenings in succession to be effective. For outdoor work he recommends mulching with fresh tobacco stems and dusting fresh tobacco dust or snuff upon the dew-moistened plants.

It will be remembered that the insect which attacked Mrs. Thaxter's carnations was an Anthomyiid larva, as determined by specimens which she sent to the Division, and our query has called forth a card from our English friend and correspondent, Mr. R. McLachlan, who reminds us that he published on page 135 of the *Entomologists' Monthly Magazine* for May, 1892, a little note concerning a similar damage to Carnations and Picotees in London. Anthomyiid larvæ are there described as living beneath the rosette of leaves forming the crown of the plant and also as boring into the stem below the crown, in some instances causing the crown to drop off. The perfect insect was determined as *Hylemyia nigrescens* Rnd. It is nearly allied to *H. cardui*, which feeds in the flower heads of thistles. Mr. McLachlan writes us,

however, that he suspects that more than one species of Anthomyiid is concerned in this work.

The rearing of the adult insect which does this damage at the Isle of Shoals becomes, therefore, of considerable interest, since *H. nigrescens* Rnd. does not occur in this country. It may turn out to be one of our native species, or it is possible that it has been imported from England, perhaps by way of Canada. No remedy beyond burning the infested plants with the contained larvæ has been suggested.

APPLICATION OF SULPHUR FOR THE RED SPIDER.

At the February 8, 1894, meeting of the California State Horticultural Society Mr. Alexander Craw read an interesting paper upon the Red Spider in which he announced that Mr. George Ditzler, of Biggs, Butte County, Cal., has constructed a broad-cast seeder in such a way that it distributes sulphur in a dense cloud over from three to six rows of trees in the time necessary to drive through. The sulphur is thrown in one direction and is applied in the morning when the leaves are damp. An almond orchard treated in this way for two seasons retained its leaves until late in the fall, whereas other orchards in the same district not treated dropped their leaves in August and September.

RUSSET ORANGES.

A little item in the New York *Confectioners' Journal*, in which golden russets and small dark russets are incidentally stated to be the best keeping oranges, has called to our mind a very general experience which we have never seen referred to in print. We buy for our own table consumption russet oranges in preference to bright oranges, and yet in our official work we are in constant receipt of requests from orange-growers for methods of destroying the Rust Mite. The hardening of the skin of the orange from the work of the Rust Mite undoubtedly keeps them juicy, improves them for shipment, and retards decay. The selection of bright oranges was a fad among growers and wholesale buyers which did not last. The time has come when russet oranges for shipment command higher prices and when remedial treatment for the Rust Mite is only necessary for a great excess of this Acarid. The change in public opinion in this matter shows that utility governs even sentiment.

DOES THE HORN FLY ATTACK HORSES?

In our experience with the Horn Fly we have never known it to injure anything but cattle. We have several times met stock-raisers who believe that they have seen it attacking horses, and Mr. J. S. Johnson, of Cheyenne Wells., Colo., writes us under date of February 27 that he found this species in numbers upon a three-year old horse in Cheyenne. Have other correspondents observed similar cases?

A LEGAL CASE IN CALIFORNIA.

An interesting case has just been tried in the courts in Los Angeles, Cal. A nurseryman named Cunningham brought 400 lemon trees to Los Angeles some time ago and they were found to be infested with Black Scale. The county officers notified Mr. Cunningham that they would have to be fumigated, and he told them he would be glad to have them do the work. One of the officers, Mr. McMullin, then fumigated the stock in the car in which it was shipped. Upon subsequent planting, some of the trees died back, and the nurseryman claimed damages. The matter was submitted to arbitration, and Mr. Cunningham, not being satisfied with the result, brought suit against John Scott, horticultural commissioner, and his assistant, Mr. McMullin, for damages. The case was decided in favor of the defendants, the judge holding that Mr. McMullin had exercised the usual precautions, that he was a competent individual, and that the damage to the stock was not the result of negligence or lack of information on his part. The damage resulted, in all probability, from the fact that the strength of the cyanide differs in different packages, and even in different parts of the same package. It was shown that the most careful men sometimes fail to fumigate without injury, and in this case the plaintiff was held to have assumed the risks inherent in the process itself. The law requiring fumigation is in the nature of a police regulation, in the enforcement of which it often happens that some individuals must suffer loss, because the law is general and can not be modified to suit particular cases.

CORRECTIONS.

By inadvertence, on page 295 of volume v, INSECT LIFE, we referred to Mr. O. E. Janson, the well-known natural history agent and bookseller of London, England, as "the late O. E. Janson." We had somehow received the impression that Mr. Janson was deceased, but we have had the best assurance from him since, that he is still in the flesh, and we hope he may remain so for many years to come.

"The last paragraph of my paper on 'Arsenical Spraying of Fruit Trees while in Blossom,' as published in the current volume of INSECT LIFE (pp. 181–185), should read as follows:

> It is therefore respectfully submitted whether there should be the intermission of spraying as proposed, urged, and sought to be made compulsory through legislation, until it shall appear beyond all controversy that the interests of the apiarist and the fruit-grower, each carefully considered and perhaps weighed one against the other, really demand it.

"The substitution of agriculturist for 'apiarist' in the paper as printed had entirely hidden a point that I desired to make."—[J. A. LINTNER.]

"Prof. E. G. Lodeman writes me that I misquoted him on p. 120, line 6, of the present volume of INSECT LIFE. Both London purple and Paris green were used in Prof. Lodeman's experiments, but it was only the Paris green that he found to possess the fungicidal properties."—[C. P. GILLETTE.]

THE PHYLLOXERA IN TURKEY.

It is not in our country alone, says *La Nature* for January 6, 1894, that the Phylloxera is a scourge. For twelve years or more it has ravaged the Asiatic coast of the Bosphorus, the territory invaded comprising more than 2,000 hectares, in 800 hectares of which the vines are completely destroyed. Within the last two years the disease has also appeared on the European side, where three hectares out of 2,500 have been attacked, and one hectare has been completely stripped. On the Bosphorus the disease has attacked at Therapia more than forty hectares, half of which is almost completely ravaged.

It has been noticed that in the environs of Constantinople the progress of the disease has been rather slow. This peculiarity is due to the fact that the vines of this region are planted at a depth of one meter. Their roots, thus attaining large dimensions underground, offer more resistance to the malady and delay its progress.

No preventive treatment has so far been employed in combatting the Phylloxera. The Ottoman Government has contented itself with establishing two nurseries of American vines, which distribute American cuttings gratuitously to viticulturists. In the last two years 200,000 of these cuttings have thus been distributed. The nurseries and the school of grafting are under the direction of M. Eckerlin, while the inspection of these establishments is confided to a graduate of the school of Grignon, Agathou Effendi, inspector of viticulture. The results so far obtained are very satisfactory, and permit the hope that it will be possible to regenerate the destroyed vineyards.

Except the Phylloxera law of April 2–14, 1880, which is still in force, no legislation has been adopted in Turkey against the disease.

In consequence of the appearance of the Phylloxera in the environs of Constantinople, notably on the Asiatic side, new plantations of vines have been made in lands of that vicinity formerly employed in different cultures, to replace the vineyards which have become unproductive. The area of these new vineyards is actually greater than that of the vineyards injured or destroyed, so that the production of grapes has remained the same and the price has not advanced.

The culture of the vine was formerly very prosperous in the province of Trebizonde, and was a source of wealth to the inhabitants; but it has been abandoned for forty years or more.

U. S. DEPARTMENT OF AGRICULTURE.

DIVISION OF ENTOMOLOGY.

PERIODICAL BULLETIN. Issued September, 1894.

Vol. VI. No. 5.

INSECT LIFE.

DEVOTED TO THE ECONOMY AND LIFE-HABITS OF INSECTS, ESPECIALLY IN THEIR RELATIONS TO AGRICULTURE.

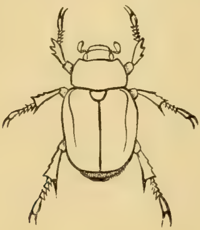
EDITED BY

C. V. RILEY, Entomologist,

AND

L. O. HOWARD, First Assistant,

WITH THE ASSISTANCE OF OTHER MEMBERS OF THE DIVISIONAL FORCE.



[PUBLISHED BY AUTHORITY OF THE SECRETARY OF AGRICULTURE.]

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1894.

CONTENTS.

SPECIAL NOTES.

Change in the Office of Chief of the Division of Entomology.—Readers of INSECT LIFE have probably already been made aware, by notices in the agricultural and other papers, of the fact that on June 1 Prof. Riley, who for more than thirteen years has held the position of Chief of this Division, resigned, largely on account of poor health and the wishes of his family. The honorable Secretary of Agriculture, following civil-service principles, has appointed the writer to the position thus made vacant. The present number of INSECT LIFE will be the last one published under the joint editorship of Prof. Riley and the writer, and will complete volume VI. The first number of a new volume will follow almost immediately. Those readers who have found something of interest in the pages of the six volumes published under the joint editorship will have frequent occasion to regret that the well-stored mind and guiding hand of the justly eminent ex-chief of the Division will no longer conduct the publication, but no one will feel the lack more deeply than the writer, who, through long years of association, had learned to appreciate as perhaps no one else could the great scientific acumen and unequaled supply of entomological knowledge possessed by Prof. Riley.—L. O. H.

The Periodical Cicada.—As is well known to readers of INSECT LIFE, Broods XII and XVIII of the Periodical Cicada appeared in different parts of the Southern and Eastern States the present season. By a thorough circularizing of the region in which the insects appeared, the Division is in possession of a large amount of information bearing upon these two broods, the region hitherto mapped having been somewhat extended in certain directions, while some of the old localities have failed of verification.

The Fluted Scale in Florida.—Many times during the past ten years we have received specimens of different scale-insects from Florida, perhaps most frequently the Florida Wax Scale (*Ceroplastes*

floridensis), with the question, "Is this the Fluted Scale or White Scale of California?" and we have referred to a number of these sendings in the early volumes of INSECT LIFE. Up to the end of May *Icerya purchasi* had not been found in the United States east of the Rocky Mountains. On the 2d of June, however, we received undoubted specimens of this insect from a large orange-grower in Hillsboro County, Fla. He wrote that upon the 26th of May he found the insects very thick upon two small trees. Their abundance upon these trees would seem to indicate that the species will thrive perfectly well in the climate of Florida, and unless active remedial measures are at once taken, the orange-growing industry in Florida is threatened with great damage. We have advised the gentleman mentioned concerning the best remedies, and the matter will be investigated by an agent of the Division, who has gone to Florida. From the present outlook it seems as though it will not be difficult to stamp the insect out, and the introduction of the celebrated *Vedalia cardinalis* into Florida will probably not be necessary.

Recent Publications of the Division.—In the pursuance of a scheme by which a number of the most important of the insect enemies of crops will be treated of in circular form, for use in correspondence in case of emergency, Circular No. 4, new series, of the Division, treating of the Army Worm, was published early in June. This insect was treated in advance of others of quite as great importance on account of the fact that the present is an Army Worm season in many of the eastern States. These circulars are to be brief and well illustrated, and are to contain a short summary of the life-history of the particular insect or insects under consideration, together with a full account of the remedies advised.

Farmers' Bulletin No. 19, of the general series of the Department, is entitled "Important Insecticides: Directions for their Preparation and Use." The bulletin was written by Mr. Marlatt and contains in 18 pages a full but compact account of the preparation and means of application of the most important insecticides which are recommended by the Division.

Bulletin 32, now in press, contains the reports of the field agents of the Division for 1893. It is a continuation of a series of these reports, the previous numbers being Bulletins 30, 26, 23, and 22.

New Edition of Hubbard's "Insects Affecting the Orange."—The edition of the report on the insects affecting the Orange by Mr. H. G. Hubbard, which was published in 1885, was exhausted within a year or two, so great was the demand from orange-growers for information of this character. Mr. Hubbard resigned his commission under the Division

after the completion of his report, and press of other work has prevented the publication of a revised edition up to the present time. The Department has been fortunate the present summer in being able to reëmploy the author of the report, and his first task will be a careful revision of his old work, so that a new edition, brought down to date, will be published before the close of the year.

Investigations of the Cause of Potato Scab and Potato Rot.—At the celebration of the completion of the West Virginia Experiment Station building at Morgantown, April 6, 1894, Mr. A. D. Hopkins, Entomologist to the Station, presented a somewhat exhaustive paper on the relation of certain Dipterous larvæ of the family Mycetophilidæ to the so-called potato scab and potato rot. As the result of extensive investigations begun in the fall of 1891 and continued up to date, Mr. Hopkins concludes that a large percentage of the damage to potato tubers in West Virginia heretofore attributed to the potato scab fungus, *Oöspora scabies* Thaxter, and to the potato-rot fungus, *Phytophthora infestans*, is caused both directly and indirectly by certain of these fungus gnats. He also believes that the attacks of the same insects are the primary cause of most forms of potato scab which are real detriments to the tubers. One of the forms more especially instrumental in producing the injurious condition referred to is an undescribed species to which Mr. Hopkins has given the MS. name *Epidapus scabies* and the common name, Potato-scab Gnat. He has ascertained that the fungus gnats which induce certain forms of potato scab breed commonly in soils containing decaying vegetable matter, animal manures, and similar substances; that lime and ashes offer favorable conditions for their increase, in promoting decomposition of vegetable matter and moisture and in presenting unfavorable conditions for the presence of insect enemies. Dry or sandy soil free from vegetable matter presents unfavorable conditions for the development of the gnats. The use of scabby seed potatoes offers favorable conditions for the attack of the insects, as these are attracted to the scabby spots, in which they breed, and are thus brought into contact with the growing tubers. Mr. Hopkins recommends soaking the seed potatoes in a solution of corrosive sublimate previous to planting. Fortunately the preventive measures found to be most effective against the scab fungus are equally applicable in the prevention of the attack and injury of the fungus gnats.

BEES.*

By C. V. Riley.

Living in such well-organized communities, exhibiting so much intelligence, and yielding one of the most delicious sweets known, the Honey, or Hive Bee has attracted attention from the earliest times, and ever since Aristotle, Virgil, and Columella told what was then known of this industrious insect, it has been the subject of investigation. Honey and wax were far more important to man in olden time than they are to us who have so many substitutes for them, and the ancients gave much attention of the practical kind to bees. How very little they knew, however, of their true economy is shown by the prevalence of the belief that bees came from the carcasses of animals. This superstition as to the *Bugonia*, as exemplified in the biblical story of Samson (Judges XIV, 8), continued for twenty centuries, and grew out of the resemblance to the Hive Bee of *Eristalis tenax*, a Dipterous fly which breeds in putrescent matter. This fact, first clearly recognized by that excellent observer, Réaumur, has been fully established in a recent most interesting paper by Osten Sacken "On the so-called *Bugonia* of the ancients, and its relations to *Eristalis tenax*." (Bullettino della Società Entomologica Italiana, Anno XXV, 1893.) In fact the fabulous about bees prevailed till the beginning of the last century, when Maraldi, by the invention of glass hives, gave an impetus to correct observation, and led to the remarkable memoirs of Swammerdam, Réaumur, Schirach, and Francis Huber.

The fact that the Hive Bee can be cultivated and controlled with a view to profitable industry has served to heighten the interest in it, and since the invention in this country, in 1852, of the movable frame hive, by a retired clergyman, the Rev. L. L. Langstroth, progress in apiculture has been rapid and continuous. Of the more important subsequent inventions, many of them made in Europe but perfected in America, may be mentioned the honey-extractor, which, by centrifugal force, throws the honey from the comb, leaving the latter intact and ready to be used again; and the comb foundation, by which sheets of wax are impressed with the bases of the cells and employed to insure straight and regular combs, to limit drone production and increase the honey product. With the bee-smoker in its modern form, bees are also much more easily controlled and manipulated than formerly. Much

* From an address on Social Insects, as President of the Biological Society of Washington, delivered in the hall of Columbian University, January 29, 1894.

has been done, also, in ameliorating the races of bees, both by introducing races from other countries and by the crossing of these. There are some three hundred thousand of our citizens engaged in bee culture, and they add over twenty million dollars annually to the wealth of the country in honey and wax. This amount may be, and in the near future doubtless will be, very largely increased. It is, in fact, difficult to realize what an immense amount of honey is wasted from lack of bees to garner it, and the poet Gray would seem to have had his own ideas on the subject when he wrote the familiar lines:

> Full many a flower is born to blush unseen,
> And waste its sweetness on the desert air.

The service directly rendered to man by bees, however, in supplying the products mentioned, is but slight as compared with the service indirectly rendered by cross-fertilization of our cultivated plants, and it has been estimated that the annual addition to our wealth by bees in this direction alone far exceeds that derived from honey and wax. One of the latest discoveries bearing on this subject, very fully enforcing the general principle, was presented to the Society for the first time within the past year by our fellow-member, Mr. M. B. Waite, as a result of his investigations for the Division of Vegetable Pathology in the Department of Agriculture. He has proved that a majority of the more valued varieties of our apples and pears are nearly or wholly sterile when fertilized by pollen of the same variety, or that they bear fruit of an inferior character and very different from that produced when cross-fertilized; further, that were it not for the cross-fertilizing agency of bees, scarcely any of these fruits could be produced in the abundance and perfection in which we now get them, and that to secure the best results and facilitate the work of the bees, it is yet necessary, in the large majority of cases, to mix varieties in the same orchard. Bees were doubtless the earliest embalmers, since they use the propolis to encase, and thus prevent the putrefaction of any intruder which is too large for them to drag out of the hive.

There is much, even to-day, in the economy of the Hive Bee that is yet debated among the best informed apiarians, but I will endeavor to give you an epitome of what is absolutely known of its more important habits, structures, and functions—the true life-history, so to speak, of the bee. By going somewhat into detail with this species, we may avoid repetition in treating of the other social Hymenoptera, all of which have somewhat similar larvæ and transformations. Let us, in imagination, proceed to an ordinary well-kept apiary. Taking a bee-smoker in one hand—one of the pattern invented by the late M. Quinby, of New York—we lift one corner of the hive cover or quilt and send enough smoke down among the bees to give them to understand that they must submit to our manipulation. Drawing out one of the brood combs, which is rendered easy by the movable frames, thousands of the bees are seen adhering to the surface of the comb. They are mostly

workers, but in summer there may be seen numbers of stouter-bodied bees, which are the drones or males. If the bees have not been too much disturbed by the smoke or the removal of the comb, the queen may be seen walking slowly over the surface, surrounded by the workers, who, in deference, recede as she walks along, turning their heads toward her and advancing so as to touch her body with their antennæ. It was long thought that the queen exercises sovereign powers, and Shakespeare voices the popular opinion when, in Henry V, he says:

They have a king and officers of sorts.

One of the earliest definitions of a queen bee in Webster's dictionary was, "The sovereign of a swarm of bees." In reality, however, the government of the hive is purely democratic. Each works for the common welfare, and only so long as the individual, whether queen, drone, or worker, is useful to the community, is it spared. With the exception of the drones, the queen is the only bee in the hive having the reproductive organs fully developed, and she is, therefore, the mother of the colony. During the more prolific season she lays two or three eggs in the course of a minute, and often as many as four thousand in twenty-four hours. Three days after deposition of the egg the young larva is hatched. It is the office of the younger worker, known as nurse-bees, to furnish these young larvæ with food, which they are assiduous in doing. In the case of the worker larvæ, five days suffice for full growth, when they nearly fill the cells. As with most other soft-bodied larvæ that are imbedded in a semiliquid nutritious medium, we find provision to prevent contamination of the environmental food with excrementitious matter. The food supply is, in the first place, highly nutritious, and nearly all capable of assimilation. Lest, however, any portion of the waste should enter the food, the larva is, according to Cheshire, rendered incapable of voiding anything during the time of feeding. The arrested development of the digestive system leaves the posterior inflection, which corresponds with the after bowel, unconnected with the middle bowel, and the slight accumulation of waste matter in this latter is cast into the base of the cell at the last molt, and is covered in the bottom of the cell by the lower part of the last cast skin or pellicle, which also serves to line the rest of the cell and leave it clean for the formation of the pupa. Thus, when the young bee emerges the cell needs but to be brushed out by the workers to be ready to receive another egg, or stores of honey and pollen which are to form the winter food.

Just before pupation, or when the larva has acquired full growth, the adult workers cover the cell with a convex lid, composed, not of wax alone, as in the case of the cappings of honey cells, but of pollen and wax combined. The larva just before pupation strengthens this cap by lining it with silk, which is also slightly attached to the last cast skin. The pupa state lasts some twelve days, and on the twenty-first day from the time the egg was laid the perfect bee cuts a circular open-

ing in the cell cap and makes its way out. The first care of this young bee is to seek food from an open honey cell, and in the course of two or more days it has acquired sufficient strength and consistence to enable it to begin its labors as a nurse bee, doing for the developing larvæ what was so recently done for it. After a week's time it takes short flights, noting well the location of its hive, so as to be able to return to it.

Queens are bred only when a colony is about to swarm, or when an aged or failing queen needs replacing, or where an accident has deprived the hive of her services. If she be removed from the hive during the working season, the bees are thrown into great excitement, shown by the change of the contented hum into one of alarm, by the hurried movements from the combs to the entrance, and by the discontented flight to and from the hive. If all the brood combs are removed the bees become panic-stricken and give utterance to a peculiar mournful note or distressed wail, quite different from the normal cheerful hum. In time, however, this excitement subsides, as they become satisfied of their loss. If the queen be returned, or the comb containing young larvæ be introduced into the hive, the whole attitude changes. The moment the first bee touches with its antennæ the queen, or a comb, or any point over which she had walked recently, it sets up a loud and cheerful hum, and the occupants of the hive, even those unable to see the comb, immediately catch the sound and crowd toward the point whence it first proceeded, repeating the jubilant note. If only a comb of larvæ be given them, they still recognize it as a deliverance from the threatened extinction of the colony. In a few hours one of the cells over a larva two or three days old will be enlarged by the partial destruction of the walls of the adjoining cells. This enlarged cell is built outward and downward, and the larva is fed on the so-called royal jelly or bee-milk. The supply of this food is always plentiful, and when a well-developed queen has issued it is not uncommon to find a quantity of the food in a partially dried, jelly-like mass in the bottom of the cell. When, preparatory to swarming, young queens are being reared, the workers have to guard them, even in the cell, from the jealous fury of the reigning queen, and the instinctive rivalry and conflict between queens, accompanied by a peculiar shrill battle cry, first noticed by the elder Huber, are quite suggestive of similar conflicts between rival queens in human monarchies.

ECONOMY OF HIVE—SOCIAL ORGANIZATION—DIVISION OF LABOR.

Each bee, as already stated, labors for the good of the commonwealth of which it is a member. Of them it might well be said:

Salus rei publicæ suprema lex.

It is the welfare of the colony which directs the actions of all, and not the will of the queen. Indeed, it would seem that the latter performs her important function—that of supplying the hive with eggs—

only when the workers will it, their own condition of prosperity as regards stores, or their anticipations of the future needs of the colony as regards population, causing them to supply the queen liberally with food rich in nitrogen—a partially digested substance, or a gland product, or perhaps a mixture of both, which she alone can not produce, yet without which any considerable production of eggs is an impossibility.

As Evans remarks:

> The prescient female rears her tender brood
> In strict proportion to the hoarded food.

We must, then, credit the industrious and provident workers with the chief influence in shaping the policy of the hive. They are the *servum pecus*—the living force—of the colony. And to the end that order and efficiency of effort may prevail, they have, we find, a marked division of labor. In the normal condition of the hive the young workers, as already stated, care for the brood—a labor which they take upon themselves within two or three days after issuing from the cell. The glands which secrete a part of the food required by the developing larvæ are active during the earlier part of the life of a worker. Later, these nurses become incapable of doing their work well as the gland system becomes atrophied. When a few days old they take short flights, if the weather favors, but seldom commence gathering stores before they are fifteen days old. Wax production is more essentially a function of the workers in middle life, and it is particularly noticeable that those bees fashioning the wax into combs are principally of this class. Many of those acting as foragers do, however, secrete wax scales, which are doubtless, in the main, utilized. Among the outside workers and hive-defenders some bring honey only on certain trips or for a time, others honey and pollen, others water, and yet others propolis or bee glue to stop up crevices and glue things fast. Meanwhile some are buzzing their wings at the entrance to ventilate the hive, and others are removing dead bees, dust, or loose fibers of wood from the inside of the hive or from near the entrance, or are guarding this last against intruders, or perhaps driving out the drones when these are no longer needed.

SWARMING.

Perhaps there is no action on the part of the Hive Bee which more distinctly indicates its intelligence and power of communication than the act of swarming. The fact that queen brood is being reared in the hive is the best evidence that the colony is preparing for flight or swarming; but in addition, it is noticeable that on the day of swarming the whole colony is excited, and in a measure has abandoned ordinary duties. For days previous to the event, scouts have been searching for a favorable hollow or crevice or place in which to house the new colony, and when the time finally comes, which is usually in the hotter part of the day, all the individuals of the hive leave after the

peculiar preparatory flight around the hive, known as swarming. The impulse to leave is such that many individuals not yet capable of flight fall to the ground, and the hive is practically abandoned by all those within it at the time of swarming. Individuals alight on some bough or object near by, with a view primarily to organization and the sending out and return of additional scouts. During this period a cluster will remain more or less in repose, but when once the location for a permanent dwelling has been finally determined upon, the whole mass will leave as with one impulse and fly swiftly and directly to the new home. With the first swarm that the new colony sends out it is the old or fertile queen that goes with the new swarm, but with the after swarms, which issue in about a week, it is a virgin queen that accompanies. The old colony begins again with the few individuals unable to follow the departing swarm, and which have crept back to the old hive, with those which at the time of swarming were busy in the field, and with those which issue from the yet undeveloped brood.

It is a popular mistake to suppose that mating takes place during swarming. If a virgin queen goes with the swarm, she subsequently takes the nuptial flight from her new home. As she flies swiftly and strongly, only the strongest and most vigorous drones are able to mate with her, and there is every opportunity for cross-fertilization with drones from some other colony. It has also been noticed that drones have a way of congregating in some particular spot as though awaiting their chance of thus mating with the queen.

THE MORE IMPORTANT SPECIAL ORGANS.

The different structures and organs of the Hive Bee are most interesting, but I can allude only to a few of the more striking. The tongue is a very complex organ, fitted for obtaining minute quantities of nectar from the flowers that secrete it but sparingly, or to remove the same substance rapidly when found in abundance. The figure of the head and appendages will illustrate this organ in detail. We have the mandible, mostly used for cutting and molding the wax, the maxillæ with their palpi, the labium and labial palpi, and finally the ligula or true tongue with its spoonlike tip. This is extremely flexible, and consists of a rod or central portion, nearly surrounded by a sheath, which is covered thickly with hairs, which aid, by capillary attraction, in taking up the liquid food. A lapping motion, when the liquid is abundant, causes the liquid to be lodged among the hairs of the tongue, which can be partially drawn into the mentum, and from this point the maxillæ above and the labial palpi below unite to form a tube around it, which is closed above the extension of the epipharynx, and by alternately arching and depressing the maxillæ, the space inclosed is increased or decreased, thus producing suction and drawing the liquid held on the tongue into the opening of the esophagus.

When drawn from the flowers the nectar is thin and watery, and lacks the qualities of the delicious honey into which we find it converted when removed from the cells sealed by the bees. This watery substance is evaporated to the proper consistency in the heat of the hive and by currents of air passing over the surface of the combs before the cells are sealed, these currents being created by bees stationed at the entrance and buzzing incessantly. There has been much discussion among apiarians, as among writers, as to whether the bee gathers or makes honey. Strictly speaking, it does both. Formic acid is contained in the blood of the bee, and especially in the salivary glands, as recently demonstrated by von Planta, of Zurich, and when the gathered nectar, which easily ferments, is regurgitated from the first stomach into the cell, it is combined with sufficient formic acid to change the cane sugar into invert sugar (dextrose and levulose in equal proportions), while the evaporating process just described eliminates the superfluous water; so that honey which resists fermentation is essentially a made product.

I would also draw your attention to the wax-producing organs. (See Fig. 23.) If we examine the under side of the abdomen of the worker,

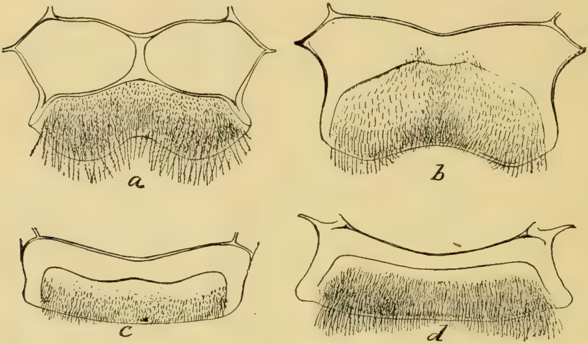


FIG. 23.—WAX DISCS OF SOCIAL BEES: *a*, Apis mellifica worker; *b*, A. mellifica queen; *c*, Melipona worker; *d*, Bombus worker—all enlarged. (From Riley.)

the exposed portion of each segment will be seen to be covered with a web of hairs, and, by elongating the abdomen, each segment, with the exception of the first and sixth, is seen to bear two shallow, irregularly shaped plates, one on each side of the median ridge, which is extended as a rim around the whole contour. These pale yellow, smooth plates are in reality wax molds, the wax glands being under the plates and the secreted wax reaching the surface by osmose through the thin membrane and hardening into a somewhat brittle scale, resembling in appearance a minute, nearly transparent fish scale. The wax is secreted under conditions of great heat, the bee ascending for this purpose to the top of the hive, and the wax producers consuming a large amount of honey.

The next structure of importance to which I would call your attention is the wax pincers (Fig. 24, A, *a*, *b*), which is a modified structure of the juncture of the tibia and metatarsus of the posterior legs. With these pincers the wax producer plucks a scale from one of its wax plates, passes it rapidly forward to the mouth, and here makes it plastic and at the same time more or less yellow, by continually manipulating and chewing it between the mandibles. Then the bee sticks it to the under surface of the hive cover or object to which the comb is to be attached. More wax is added, forming a slight ridge, which is chiseled or pressed from each side by workers, using their firm and highly polished maxillæ, and placing themselves so that their range of work will overlap just one-half. As this ridge is built down, forming a sheet—the septum upon which the cells are constructed—the sides of the latter are started simultaneously. In their efforts to make the cells concave at the bottom and so as to fit together at the sides without loss of material, mutual pressure results in straight lines, the sides

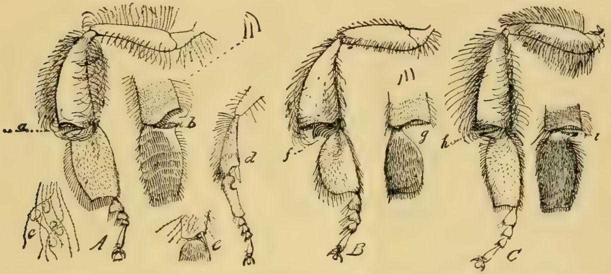


FIG. 24.—MODIFICATIONS OF THE HIND LEGS OF DIFFERENT BEES: A, *Apis*: *a*, wax cutter and outer view of leg; *b*, inner aspect of wax cutter and leg; *c*, compound hairs; *d*, anterior leg, showing antennal scraper. B, *Melipona*: *f*, peculiar group of spines at apex of tibia; *g*, inner aspect of wax cutters and first joint of tarsus. C, *Bombus*: *h*, wax cutter; *i*, inner view of same and first joint of tarsus—all enlarged. (From Riley.)

becoming hexagonal in outline, just as six soap bubbles resting against a seventh causes the latter to assume a hexagonal form; while the bee starting a cell on the bottom of one already commenced on the other side naturally takes the apex of the latter as a part of the boundary of its own cell in order that the latter may also be concave. Thus three rhomboidal faces forming the base of one cell form individually a part of each one of three cells on the opposite side.

Finally, I would call your attention to the arrangement of the hairs on the inside and outside of the legs (Fig. 24, A), so well fitted for collecting and holding pollen, and to what is known as the antennæ-comb or strigil (Fig. 24, *d*), a structure with which the bee cleanses itself, and especially the antennæ, which are organs of extreme sensibility and need to be kept well cleaned. This structure occurs on the under side of each front leg and is a semi-circular cavity in the upper end of the

metatarsus. The cavity is fringed with stiff hairs or spines, forming a comb. The distal or opposing end of the tibia is furnished with a spur, slightly concave on the inner surface and known as the velum. When the tibia and metatarsus are bent at right angles the velum falls over the cavity and forms an almost circular opening just large enough to snugly hold one antenna.

These are the more conspicuous structures, though there are others of minor importance, all indicating remarkable adaptation to special purposes and to the necessities of the bee.

The Hive Bee is but one of the many species of its family, and while representing the most highly organized of the social insects, has many cousins and more distant relatives which are equally interesting. The numerous bees, with their diversified habits, have an especial interest, when studied structurally and biologically, as throwing light on the origin and development not only of the higher social habits and intelligences of the true Hive Bee, but also of its structures, so remarkably fitted for their special purposes.

SPECIES OF GENUS APIS AND VARIATIONS IN APIS MELLIFICA.

The old conception of the Hive Bee, its attributes and structures, was that it exemplifies in a marvelous manner creative wisdom for man's interests. Yet, while it represents great perfection of organization and of structure, for particular ends, this perfection is relative and not absolute. Though a number of species of the genus Apis have been characterized by authors, there are but four well-defined species so far known, and three of them—*A. dorsata*, *A. indica*, and *A. florea*—are confined to India and the East Indian and Philippine Islands. The fourth, *Apis mellifica*, or the common Hive Bee, was originally introduced into this country from Europe, and doubtless had its origin in some parts of Asia. It has followed civilized man in his migrations over the globe, and has frequently anteceded him, and, being semi-domesticated, has been more or less influenced by him, as have other domesticated animals. Some ten different types of the species have been characterized by specific names, two of them, viz, *adansoni* Latr. and *unicolor* Latr., being considered good species by Frederick Smith, while a still greater number are recognized by local names among apiculturists. These varieties and races show every variation in color through the various shades of black, gray, and golden-yellow, as also every variation in disposition, industry, and tendency to swarm, and especially in honey-gathering proclivities.

Of the East Indian species only one, *Apis indica*, is cultivated. This bee, which is considerably smaller than our own, building smaller combs composed of smaller cells (36 to the square inch), chooses, when wild, a hollow tree or rocky cavity for its home. It is kept to a limited extent by the natives, earthen jars being used for hives, but the yield of honey is small.

Apis florea, the smallest of the genus, with slender, orange-banded body, builds in the more open country of India, attaching a single tiny comb to the twig of some small shrub. The worker cells are 81 to the square inch of surface, the drone cells 36.

Apis dorsata, the Giant Bee of India, attaches its mammoth combs to the limbs of tall forest trees or to overhanging ledges of rock, generally building a single comb as much as six feet long and two or three feet wide. Great quantities of wax and honey are obtained from this bee by the bee-hunters in India and the islands southeast of Asia. It has not been permanently domesticated, nor is it certain that it can be. The workers of this species are about the size of the queens of *Apis mellifica*, or from seven-eighths of an inch to an inch long. The bodies of the bees are slender and wasp-like, and beautifully marked across the abdomen with bright orange bands.

While the different species of the genus Apis thus differ in size, coloration, temperament, and habit, there are comparatively slight

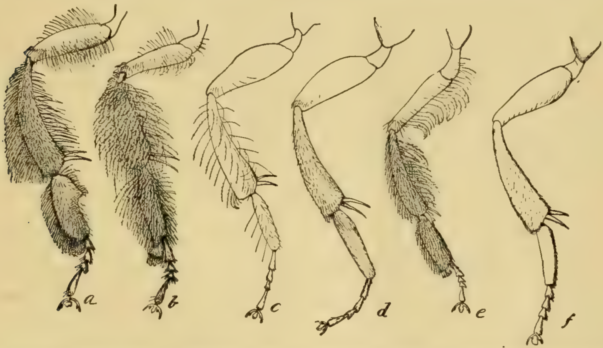


FIG. 25.—MODIFICATIONS OF THE HIND LEGS OF DIFFERENT BEES: *a*, Anthophora; *b*, Melissodes; *c*, Perdita; *d*, Nomada; *e*, Agapostemon; *f*, Nomia—all enlarged. (From Riley.)

variations in structure; a necessary inference for every zoölogist. But if we study the other species of the family Apidæ we shall find every variation, and obtain a very good idea of how the special organs in Apis may have been evolved and perfected from simpler organs in other genera. This may be illustrated by a few sketches of some of the more important structures, as, for instance, the polliniferous organs and the wax-producing apparatus. (See Figs. 23, 24, and 25.) The figures very well illustrate the fact that the modification of structure and hairy vestiture, which facilitates the collection and transportation of pollen, while exhibited perhaps in the greatest perfection in the Hive Bee, is nevertheless an evolution from similar structures possessed by other species of social bees, such as the Meliponæ and Bombi, and still more remotely from such as are possessed by the solitary bees.

In the production of wax the Hive Bee exhibits a lavishness not found in any of the wild bees, not excepting the species of Trigona and Melipona, which approach it most nearly in social economy. As a result we find that the wax-secreting organs of Apis are much larger than in any other wax-producing bees. In Bombus they are greatly reduced and otherwise different in structure, resembling, however, very closely those obtaining in Melipona and Trigona.* In the solitary bees, which produce no wax, these specialized structures are entirely wanting. These solitary bees, no matter in what situations or of what material they make their cells, generally store them with honey or pollen, and after depositing an egg, cap the cell and leave the young larva to care for itself. The habits of the social Bumble-bee (Bombus) are but a step in advance, as the larvæ are developed in a mass of pollen and honey, in which they form rather imperfect cells. When full grown each spins a silk cocoon which is thickened by a certain amount of wax, which is added by the adult bees. The females labor, and several coöperate in the same nest. In the Bottle-bees (Melipona) a still further step is seen, as the cells, of a rather dark, unctuous wax, are formed into regular combs and are somewhat imperfectly hexagonal. They are, however, in single horizonal tiers, separated and supported by intervening pillars, more like the nests of the social wasps, and the cell is sealed after the egg is laid upon the stored food, just as in the case of solitary bees. The honey is stored in separate flask-like cells, and but one queen is allowed to provide eggs.

THE SAN JOSÉ OR PERNICIOUS SCALE.†

(*Aspidiotus perniciosus* Comst.)

PREVIOUS INVESTIGATIONS.

In the Annual Report of this Department for 1880 Prof. J. H. Comstock described under the above name an insect which he had collected in Santa Clara County, Cal. He stated that from what he had seen of the species he considered it to be the most pernicious scale insect known in this country. He had never seen any other species so abundant as this was in certain orchards, and was told that it infested all the deciduous fruits grown in California except the peach, the apricot, and the black Tartarian cherry. As a remedy he suggested the use of strong alkaline washes.

* But the most interesting fact is that in the queen bee, in which they are functionless, they are nevertheless present, but more nearly resemble the same structures in Melipona.

† Republished, with some additions, from the Report of the Entomologist, Annual Report of the U. S. Department of Agriculture for 1893, and circular No. 3, new series, Division of Entomology.

Until very recently the San José Scale has been confined to the Pacific coast, but has extended north to Washington and south to the Mexican border, and has become, perhaps, the chief enemy to Pacific-coast horticulture. Considerable attention has naturally been paid to the species by California horticulturists.

In 1883 Matthew Cooke published figures of the larva, male pupa, and adult male, together with the adult female scales on twig and fruit. He stated that the insect was first noticed by fruit shippers as infesting fruit in 1873 at San José, Santa Clara County. From that time it spread rapidly until 1880, and but little effort was made to exterminate it. In the winter of 1881–'82 crude petroleum was applied extensively; in some cases with good results, but in the majority of instances with great harm to the trees, many trees dying from the effects. The remedies recommended were 1 pound of concentrated lye to a gallon of water and 6 pounds of caustic soda to 12 ounces of potash and 8 gallons of water. These remedies were to be applied only at the dormant season. For trees in leaf a wash composed of one pound of whale-oil soap, one-third of a pound of sulphur, and an ounce and a half of lye or caustic soda to a gallon of water was recommended.

In 1884 the late Dr. S. F. Chapin, in his biennial report as State inspector of fruit pests, mentioned the San José Scale, but stated that in Santa Clara County, where it first appeared, there had been a most gratifying decrease in its numbers and in the destrûctive effects following its presence, both results having been brought about by the intelligent and well-directed efforts of the fruit-growers. He stated that the scale had been found at that time in many different localities in the State, but had not caused any great decrease in orchard products. He urged that the pest should be watched and treated in its incipiency.

In the biennial report of the State Board of Horticulture of California for 1885–'86, the late W. G. Klee, then State inspector of fruit pests, published a short account of the insect, illustrating its characteristic appearance upon twig, leaf, and fruit. Mr. Klee stated that the insect has three distinct broods—one in June, one in August, and one in October; but that these broods overlap, and in consequence the summer washes are not thorough remedies unless frequently repeated. He therefore recommended winter treatment, consisting of the cutting back and thorough thinning of all trees above 20 feet in height, together with thorough scrubbing of the rough bark of the old trees and the application of one-half pound of concentrated lye, one-half pound of commercial potash, and 5 quarts of water.

In the Proceedings of the Eighth Fruit-growers' Convention, published in the report of the State board of horticulture for 1887–'88, Prof. C. H. Dwinelle is said to have reported the most perfect success in fighting the San José Scale in Sonoma County, Cal. A seriously infested orchard was treated with absolutely complete success by means of a wash composed of one-half pound of commercial potash, one-half pound

of caustic soda, and 5 quarts of water. This was applied when the trees were in a dormant condition.

In the report of the same board for 1889 a reprint is given of Comstock's description in an article upon scale insects and remedies. Several formulæ for summer and winter use are given, the most successful of which, and the one which has come into most general use, being the so-called lime-sulphur-salt wash for winter use. This wash consists of 40 pounds of unslaked lime, 20 pounds of sulphur, 15 pounds of stock salt, and water to make 60 gallons. The summer washes comprise potash and caustic soda, whale-oil soap and sulphur, with a slight admixture of caustic soda and potash, and a mixture of tallow and resin with a small quantity of caustic soda and potash. In the report of the board for 1891 Mr. Alexander Craw published an article entitled "Insect pests and their extermination," in which he briefly discusses this species. He considers it to be a very serious pest of deciduous trees, but states that the remedies just mentioned are so cheap and effective that no excuse can be tolerated for a seriously infested orchard. He further stated that a Chalcidid fly (*Aphelinus fuscipennis* Howard) had been found doing such effective work in subduing the species in an orchard in the neighborhood of Los Angeles that a complete restoration of the orchard was confidently expected.

In Bulletin 26 of this Division Mr. Coquillett, in his report on the scale insects of California, devotes four pages to this species. He states that its origin is uncertain, but that the fact of its being so frequently found upon plants imported from Japan would seem to point to that country as its original home. He states that the species never attacks citrus or coniferous trees, and that the LeConte Pear, when growing in the midst of other varieties of Pear, is almost exempt. The Twice-stabbed Ladybird (*Chilocorus bivulnerus*) is mentioned as being the most abundant and efficacious enemy of the scale, although Mr. Coquillett has never known an instance where even one single tree has been entirely or very nearly freed from the scale by the work of this beetle. The article concludes with a series of experiments with washes. The result of these experiments was that the resin and caustic soda wash recommended by Mr. Coquillett in Bulletin 23 of the division was found to be superior to the others. This wash is to be applied only during the dormant season, and consists of 30 pounds of resin, 9 pounds of 70 per cent caustic soda, 4½ pints of fish oil, and water to make 100 gallons.

Mr. Coquillett's testimony as to the good offices of *Chilocorus bivulnerus* coincides with that of other observers, but a surprising instance, which indicates that the species may occasionally prove extremely effective, was mentioned in the *California Fruit Grower* in 1892. It was there stated that Mr. N. W. Motheral procured a number of these beetles in San Diego County [date not given] and placed them in some orchards in Tulare County which were badly infested with the scale. They did not appear to multiply greatly until the spring of 1892,

"when immense numbers appeared simultaneously and completely cleared the orchards of the county of the scale."

An interesting ladybird of the genus Scymnus was found in 1892 by Dr. Blaisdell preying upon the San José Scale at the Coronado parks, near San Diego. This species was described by Dr. Blaisdell as *Scymnus lophanthæ* n. sp., but has not proved very effective in destroying the Aspidiotus.

In the September, 1892, number of the *Agricultural Gazette* of New South Wales Mr. A. Sidney Olliff reported the receipt of a typical series of *Aspidiotus perniciosus* on the fruit, leaves, and twigs of Pear from West Maitland, New South Wales. Mr. Olliff further stated that although this species had not previously been recorded as occurring in Australia, it had been known to some fruit-growers for a number of years.

In an important paper read by Mr. Alexander Craw before the State Horticultural Society of California, December, 1892, the San José Scale is stated to be unquestionably of foreign origin, and it is further surmised, on the authority of Mr. John Britton, of San José, that it was introduced into California upon trees received from Chile by the late James Lick.

In Bulletin 7 of the New Mexico College of Agriculture, published in June, 1892, Mr. C. H. Tyler Townsend, entomologist of the station, records the occurrence of the species at Las Cruces upon apple, pear, plum, peach, quince, and rose, and states that it was brought into New Mexico on young trees from California. The winter eggs are mentioned in Mr. Townsend's account as turning orange-yellow in spring and hatching the first or second week in May.

SUDDEN APPEARANCE OF THE SPECIES IN THE EAST.

The first week in August, 1893, Dr. C. H. Hedges, of Charlottesville, Va., sent specimens of pears and peaches affected by this insect to the Division of Vegetable Pathology of this Department, on the supposition that the scales were the manifestation of a fungous disease. They were referred to this Division and Dr. Hedges was informed of the destructive character of the insect, and advised to spray with kerosene emulsion, as examination of the specimens showed that the insects were hatching at the time. He was unable to trace the origin of the trouble. He sent specimens from pear, currant, plum, Japanese plum, and dwarf apple.

In view of the great importance of the subject, Mr. E. A. Schwarz was sent to Charlottesville about the middle of August to make a thorough investigation, and in December Mr. D. W. Coquillett was sent to continue them, and to definitely delineate the area of infection. From the detailed reports submitted it appears that the scale occurs most abundantly in a little pear orchard forming a square of about one-third of an acre about one-third of a mile from the center of the city, adjoining one of the main roads leading into the open country. The orchard

is practically isolated, being bounded upon one side by a vineyard, on another by the garden of a neighbor, on a third side by the road, and on the fourth by a lawn. It is planted with choice dwarf fruit trees, mainly pears. They are crowded together, and in many cases the branches interlock. The orchard was set out about eight years ago, and is now very badly infested. The quince and Japan persimmon carry no scales; a few occur upon dwarf apples and a few upon peaches. The Lawrence pears are also but slightly affected. The Duchesse d'Angoulême and its varieties, and the Bartlett and its varieties are very badly attacked, particularly the former. Raspberry bushes are not affected, but currant bushes are covered. A few specimens also occurred upon rose bushes. Two hundred feet away from the infested orchard, and in the middle of the vineyard, other apple, peach, and pear trees occur, but all were absolutely free from scales. Two old apple orchards at a very considerable distance were also absolutely free. In point of fact, the insect had not spread to the north, east, or west. Towards the south, however, it had spread to some extent into the garden of a neighbor. This is a flower garden, but contains a few scattered fruit trees. In this garden the scales were found in moderate numbers on a peach tree, on some pear trees, and on two rose bushes. Still further south is another garden belonging to a neighbor, and in this garden a few specimens of the scale were found upon a single pear tree.

The insect is therefore definitely limited and confined to a small space, and there seems to be no doubt that the species made its first appearance in Dr. Hedges' pear orchard. It is also undoubtedly a recent importation, since the orchard was planted only eight years ago, and since the species has spread so slightly.

Mr. Schwarz was able to gain no definite information concerning the mode of importation. Dr. Hedges has never bought any nursery stock or other plants from California. His oldest trees were purchased eight years ago in New York. Certain others were purchased in Augusta, Ga., three years ago, and two years ago another lot was obtained from Crozet, Albemarle County, Va. The time of purchase of the last lot coincides with the time when the scale was first noticed, but Dr. Hedges is positive that these trees were not infested when purchased, and states that the scales were first noticed at another point in the orchard among the oldest pear trees, near certain old currant bushes which died and were removed before the scales were noticed upon the trees. Mr. Schwarz then inquired as to the history of these currant bushes, and ascertained that they were purchased eight years ago from a New Jersey nursery. Dr. Hedges thinks that they died from a scale insect attack, but since this was long before the scales were noticed in the pear trees, the statement is doubtful. Moreover, had the insect been originally introduced upon currant bushes eight years ago, the whole orchard would probably have been infested long since, and the insect would have spread to a much greater distance.

The question as to the mode of importation is, then, surrounded with considerable difficulty, and it would seem, at the first glance, more plausible that the insect had become accidentally established from California fruit than from nursery stock. This was the conclusion to which Mr. Schwarz came after his investigation. He found that California pears are sold in the fruit stores of Charlottesville, and also upon the trains of the Richmond and Danville Railroad passing through the city. He therefore suggests the plausible idea that some person passing along the highway had tossed the rejected portions of a pear over the fence, and that from this small beginning the difficulty originated. In support of this view it may be stated that the insects gather by preference in the pit around the calyx end of the fruit, where they are not likely to be noticed and from which point they can not be rubbed in polishing the fruit with a cloth. Against it, however, is the further fact that not a single specimen of this insect on California pears has ever been noticed in the Washington markets. Its appearance is so characteristic that it could hardly fail to attract the attention of an entomologist, and yet none of our assistants have ever seen one, although California pears are extremely abundant on the fruit stands of Washington, as in most of our eastern cities. Moreover, the greatest care is exercised in California to offer only perfectly clean fruit for sale, and there are State laws prohibiting the sale of infested fruit. Two years and a half ago a case was reported in the *California Fruit Grower*, where a Riverside fruit dealer was fined $10 for selling fruit infested with this scale insect, and since that time the law has been more or less rigidly enforced. Moreover, if infested fruit were commonly brought to eastern markets, cases similar to this would have been of frequent occurrence. Indeed, it is difficult to suppose that in this event the species would not have long since obtained a foothold all through the East, since it would easily establish itself upon almost any deciduous plant near which living specimens might find themselves.

This argument, written in December, 1893, has been borne out by subsequent developments. The San José Scale has since been found in great numbers in extensive orchards near De Funiak Springs, Walton County, Fla., at Riverside, Charles County, Md., at Neavitt, Talbot County, Md., in several localities in New Jersey and eastern Pennsylvania, and upon a few trees only at Bartle, Washington County, Ind. In all of these cases the introduction of the scale has been traced directly to nursery stock received from New Jersey or Missouri.

APPEARANCE OF INFESTED TREES.

During summer it is noticeable that the scale has a tendency to infest only the extremities of the trees or the new growth, especially of the lower branches, and the fruit. The leaves are attacked (and Mr.

Schwarz found this particularly true of the Duchess and Bartlett pears) along the midrib on the upper side of the leaf in one, two, or more quite regular rows, also to some extent along the side ribs, the male scales predominating over the female in such situations. The infested leaves turn purplish-brown, but do not have a tendency to fall. When occurring upon the fruit the scales have a distinctive peculiarity, in that they are invariably surrounded by a purplish discoloration of the skin of the fruit, and this discoloration is also noticed to some extent on the young growing twigs. The cambium layer of wood beneath the scales is stained purplish to some extent. In winter the scales upon

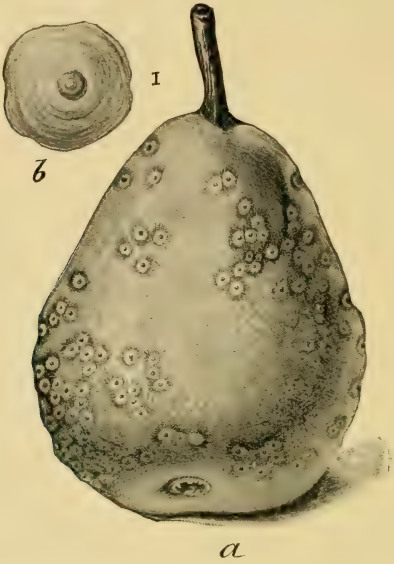


FIG. 26.—San José Scale: *a*, pear, moderately infested—natural size; *b*, female scale—enlarged. (From Circular No. 3, Div. Ent.)

twigs are difficult to distinguish. They lie close to each other, frequently overlapping, and can only be differentiated with a magnifying glass. The general appearance which they present is of a grayish, very slightly roughened, scurfy deposit. The natural rich reddish color of the limbs of peach and apple is quite obscured when these trees are thickly infested, and they have then every appearance of being coated with lime or ashes. When the scales are crushed by scraping a yellowish, oily liquid will appear, resulting from the crushing of the soft, yellow insects beneath the scales. An infested pear is shown at Fig. 26 *a*, and an enlarged female scale at *b*. The appearance of an apple twig

infested by the scales during winter is shown at Fig. 27, while the slightly enlarged scales are shown above at the left in the same figure.

NATURAL ENEMIES AT CHARLOTTESVILLE.

No parasites, and no scales from which parasites had issued, were observed at Charlottesville. The common little Malachiid beetle (*Collops quadrimaculatus*) was observed feeding in small numbers upon the newly-hatched larvæ. The Coccinellid beetle (*Pentilia misella*) and its larvæ were very abundant on the infested trees, and this species Mr. Schwarz thinks a very important enemy of the scale. The beetles seem to prefer the full-grown female scales, while the larvæ feed upon Aspidiotus larvæ. The larvæ customarily transform to pupa within the calyx of the pears. This little cavity was always found literally filled with a mass of young and old scales, full-grown Pentilia larvæ and pupæ, and recent imagos. The fact that this beetle, which is essentially an eastern species, so readily and effectively began to feed upon this introduced scale is a very interesting one entomologically, and would justify an effort to introduce and colonize it in southern California.

FIG. 27.—San José Scale: Apple branch, with scales in situ—natural size; enlarged scaels above, at left. (From Circular No. 3, Div. Ent.)

HOW THE SPECIES IS DISTRIBUTED LOCALLY.

Some interesting observations were made by Mr. Schwarz upon the transporting of the young Coccid larvæ by other insects. This very Pentilia was unconsciously an active agent in this dangerous work. Hardly one of the beetles could be found which did not carry on its back at least one Aspidiotus larva, and sometimes three or four were found upon a single wing-cover of a beetle. A small black ant (*Monomorium minutum*) was abundant upon the pears, attracted by the juice emerging from the cracks, and almost every one of these ants carried on its back one or more specimens of the Coccid larvæ. Specimens of a little Chrysomelid beetle (*Typophorus canellus*) were also found upon the trees. Red and black specimens of these beetles occurred, and the interesting observation was made that while the Aspidiotus larvæ crawled freely upon the black individuals, no specimens were to be

found upon the red ones. This same peculiar fact was also found to hold with the ants, since the red ant (*Formica schaufussi*) was abundant upon the pears, but no specimens were found bearing Aspidiotus larvæ, while, as just stated, the little black Monomorium was always found carrying specimens. Curiously enough, no ladybirds other than Pentilia were seen. The common Twice-stabbed Ladybird (*Chilocorus bivulnerus*), which is so sctive an enemy of scale insects and plant-lice throughout the Southern States, was absent.

STAMPING OUT THE SPECIES AT CHARLOTTESVILLE.

Believing, from Mr. Schwarz's report, that the area in which the insect occurs around Charlottesville was yet limited, and feeling the importance of effectual steps being taken to stamp it out, because of the danger of its future spread to the rest of the State of Virginia and to the whole Atlantic fruit region, the Entomologist was anxious to still more definitely delimit its range, and Mr. D. W. Coquillett, who has had much experience with the insect in California, was directed to make a second survey of the field. He spent some time at Charlottesville in December, and his report fully confirmed the observations of Mr. Schwarz, and showed that the species was limited to the region already indicated. On account of the small number of trees concerned, it was deemed best to make an effort to stamp the scale out by means of the gas treatment. Mr. Coquillett was accordingly sent to Charlottesville in March, with the necessary apparatus, and, with the coöperation of Dr. Hedges and Mr. H. L. Lyman, of the Virginia State Board of Agriculture, every infested tree was thoroughly treated, with the result that we are able to announce the practical extermination of the scale at this point. It has since been found upon two or three small, untreated plants, and these have been destroyed by Dr. Hedges by burning.

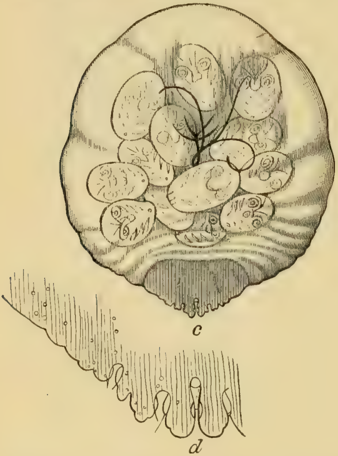


FIG. 28.—San José Scale: *c*, adult female containing young—greatly enlarged; *d*, anal fringe of same—still more enlarged. (From Circular No. 3, Div. Ent.)

DESTRUCTION OF THE SCALE AT OTHER POINTS.

In the large orchard at Riverside, Md., extensive spraying operations have been conducted, and the scale is now under control. Both the kerosene emulsion and the resin wash have been used in these operations. The kerosene emulsion is effective against the young

scales, and the resin wash, in the absence of immediately following rains, against the full-grown insects. Similar operations have been begun at Neavitt, Md. In Indiana the scale was confined to a very few trees, and these were destroyed by cutting down and burning. In the only locality in Pennsylvania with which we have had direct correspondence, the scales were also destroyed by burning the trees. In New Jersey, as we learn from Prof. John B. Smith, kerosene emulsion has been used successfully, both prior to the hatching of the young and subsequent thereto.

STRUCTURAL CHARACTERS OF THE INSECT.

A careful study of the life-history of the insect is being carried on in the Insectary of the Division. For the purposes of this article it will

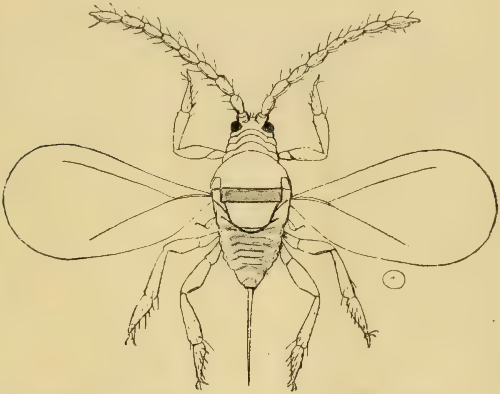


FIG. 29.—San José Scale: male adult—greatly enlarged. (From Circular No. 3, Div Ent.)

be sufficient to republish the figures of the adult male and of the adult female, removed from the scale. These are shown, respectively, at Figs. 29, 28, and 26 *a*.

COMPLETED LIFE-HISTORY OF THE SUGAR-BEET WEB-WORM.

(*Loxostege sticticalis* L.)

By L. O. HOWARD.

In the Annual Report of this Department for 1892 Prof. Riley gave, on pages 172 to 175, some account of the occurrence of this insect in injurious numbers in sugar-beet plantations in Nebraska, his attention having been called to it by the agents of the Division of Chemistry

stationed at the Experiment Station at Schuyler, Colfax County, Nebr. The same year the matter was investigated by Mr. Lawrence Bruner, who reported briefly upon the species upon pages 37 to 40 of Bulletin No. 30 of this Division. In INSECT LIFE (vol. V, pp. 320–322) was published an editorial article giving the results of brief observations made during the fall of 1892 and early spring of 1893.

During the summer of 1893 damage to sugar-beets was not noticed, and the outbreak of 1892, which attracted so much attention, must be considered as unusual and, perhaps, owing to unusual conditions. Mr. Bruner shows that the insects were more plentiful in the middle of large fields than in small ones and in those which were allowed to run to pigweed (Chenopodium) the preceding year than those in which these weeds were kept down. It was also more abundant in places where the soil was sandy than elsewhere. It is believed, therefore, that Chenopodium is the normal food-plant of the species.

In these several accounts certain details in the life history of the insect are omitted and these I may briefly mention in this article.

The larvæ were first observed in 1892, in the latter part of July, when they appeared in enormous numbers in the beet-fields at Schuyler. An August generation followed, and although in the Annual Report for 1892 it was surmised that there were three and possibly four generations, the fact was not definitely known. The moths issued in the Insectary at Washington the last week in May and the first week in June, from cocoons sent in the latter part of September from Nebraska, and also early in May from the same location, making it reasonably certain that there is a June generation of caterpillars and that the insect is in Nebraska normally three-brooded.

The method of hibernation is in the larval state within a long, subcylindrical silken case closely plastered with earth, such as is figured in INSECT LIFE (vol V, p. 231, Figs. 43*d* and 45*a* and *b*). In the Insectary the larvæ transformed to pupæ during May. A lot of cases received in May, 1892, from Nebraska contained 72 in the larval condition and 53 in the pupal condition. One of the larvæ had just changed to pupa. The first moth issued May 10 and the last one June 9.

During the same year (1892) the same insect was received from Mendon, Mich., where it was reported as damaging Tansy grown by one of the members of the so-called "Park Central Mint Growers' Coöperative Association." The patch in which the larvæ were found contained five or six acres in rows three feet apart. The larva first made its appearance in August and caused very considerable damage by eating the leaves. A later brood appeared the latter part of September and caused the loss of about 50 per cent on the yield of oil from the patch. The larvæ were cared for in the Insectary and the first moth issued May 11, 1893. Other food-plants of the species will doubtless be found.

PARASITES.

Mr. Bruner, in Bulletin 30, stated that the insect was subject to the attacks of a number of parasitic insects, while it also was preyed upon by several predaceous insects. The most abundant parasite he found to be a "small yellowish hymenopterous fly." He also mentions a "flesh-fly" and states that "several other parasites have thus far been bred from the web-worms contained in breeding cages." This state-

FIG. 30.—*Cremnops vulgaris*: female—enlarged, with lateral view of head at left—still more enlarged (original).

ment is corroborated by our experience at Washington. The "small yellowish hymenopterous fly" which is mentioned by Mr. Bruner is probably one of two species of the genus Meteorus reared here. The most abundant of these is *M. œcopsidis* Ashm., which was reared in May and early June from cocoons received from Mr. Walter Maxwell, of Schuyler, Nebr., during the same month. This species was previously reared by Miss Murtfeldt from an undetermined Tortricid larva of the genus Eccopsis. The other Meteorus was *M. indagator* Riley, one specimen of which was reared May 11 from a cocoon received the previous fall from Mr. H. A. Edson. This species was previously reared by Prof. Riley from one of the little cabbage-worms—*Evergestis rimosalis* Gn., from Oxford, Miss. Most abundant of all of the parasites, however, was *Cremnops* (*Agathis*) *vulgaris* (Fig. 30), 17 specimens of which were

reared the last week in May and the first week in June from the cocoons received from Mr. Maxwell. Two specimens of *Chelonus electus* Cr. (Fig. 31) were reared on the 6th and 8th of June from the same lot of cocoons and a single specimen of *Limneria melanocoxa* Ashm. was reared on the 22d of May. The smooth, shining, semitransparent cocoons of the Cremnops are found occupying the rear portion of the long cocoon tube of the web-worm. Their location is indicated at Fig. 45*b*, p. 321, vol. v, INSECT LIFE. Of the smaller, tougher, dark-brown cocoons of the Meteorus three or four may be found in a single case of the web-worm. We are unable to identify the cocoons from which the Chelonus and Limneria issued.

FIG. 31.—*Chelonus electus*: female—greatly enlarged (original).

In addition to these hymenopterous parasites two Diptera have been reared. They have been named by Mr. Coquillett. The first is a single specimen of *Sarcophaga helicis* Towns. (See *Psyche*, Feb., 1892, p. 220), the type of which was reared by Mr. H. A. Surface from a living snail. The case of the Sugar-beet Web-worm, from which this fly emerged, was fortunately found. The anterior portion was occupied by the puparium of the fly and the posterior portion by the dry and shriveled skin of the web-worm larva. This was one of the cocoons sent to us by Mr. Maxwell in May, 1893. The Sarcophaga emerged on the 5th of June following. The second Dipteron is *Phorbia fuscipes* Zett. This is the species which was found abundantly during the outbreak of the Rocky Mountain Locust to feed upon the eggs of the locust, and was described by Prof. Riley as *Anthomyia radicum* var. *calopteni*. Mr. Coquillett also informs me, after an examination of Fitch's type of *Hylemyia deceptiva* now in the collection of the U. S. National Museum, that this insect, called by Fitch "the Deceptive Wheat-fly," is also identical with this species. The species has also been reared by Prof. Riley from cabbage and radish roots. The parasitism of the species on the web-worm larva is very doubtful, and it is more likely that the Phorbia larva, from which this fly was reared, fed upon the beet root and perhaps crawled into the larval case of the web-worm for pupation. In view, however, of the well-known locust-egg-feeding habits of this species the fact is well worth mentioning here. Of the hymenopterous parasites above mentioned the Cremnops, the Limneria, and the Chelonus have, so far as I know, never before been reared.

REMEDIES.

From our study of this insect, we may conclude that the damage done by it in 1892 in beet fields was very unusual and hardly likely to recur except under peculiar conditions. The insect is not likely to reproduce in numbers for two consecutive years upon a crop which must be as thoroughly cultivated as the sugar-beet, and such an outbreak will seldom occur except where waste land, on which the normal food-plant of the species grows in quantity, is broken up and seeded to some cultivated crop, like the beet, which is closely allied to the natural food-plant. The plain inference points to the avoidance of such a course.

When the insect itself appears on a plantation of sugar-beets, the crop should at once be sprayed with an arsenical mixture. A few days' delay may work very considerable damage, as the larva feeds ravenously and develops with great rapidity. According to an interesting manuscript report by Mr. H. B. Edson, small holes were observed in the leaves at first without the larvæ being discovered and in thirty-six hours from that time half of the foliage of a plat was destroyed. Paris green should be applied at the rate of one pound to 100 gallons of water. The hibernating larval cases are found near the surface of the soil and a thorough harrowing will bring the majority of them quite to the surface, where they will be exposed to frosts and to the attacks of insectivorous birds and animals. Mr. Maxwell found after an experiment of this kind that the following spring the exposed cocoons had been largely emptied by birds such as the Meadow Lark and Quail, while the great majority of the remainder were dead.

NOTES FROM CORRESPONDENCE.

Abundance of the Peach-twig Borer in Washington.—The well-known Peach-twig Borer of the East (*Anarsia lineatella*) has been doing considerable damage in the State of Washington, as we learn from Mr. Chatfield Knight, member of the State Board of Horticulture, who lives at Vancouver. Mr. Knight has noticed as many as 100 of the larvæ of this insect upon a single three-year-old prune tree.

Potato-tuber Moth.—Mr. Max Albright reports the recurrence of the Potato-tuber Moth (*Lita solanella*) in California, in the country between Los Angeles and Santa Monica.

Grasshopper Damage in Minnesota.—Mr. H. B. Ayres reports that *Camnula atrox* is very abundant at Carlton, Minn. He wrote, under date of July 7, that for two weeks they had been marching west and were then flying, rising like bees and making flights farther than one can see, but nearly always westward.

A new Chrysomelid on Apple in California.—We have received, through Mr. Gustav Eisen, of San Francisco, Cal., specimens of a Chrysomelid beetle, *Colaspidea smaragdula* Lec., with the information that it appeared during May in apple orchards. Mr. Coquillett, of this office, states that he has observed this beetle feeding upon leaves of grape and other plants, including *Artemisia californica*. It is evidently a general feeder like the allied *Typophorus canellus* and *Graphops nebulosus*, the so-called strawberry root-borers, and feeds in the larval condition on the roots of one or more of these plants.

The Army Worm the Present Summer.—Owing largely to the drought of last season and the wet spring of the present year, the Army Worm has appeared in injurious numbers in several localities in the eastern States. We have had reports from Richmond, Va., May 29; Chester, Va., June 5; East Hampton, L. I., N. Y., July 9; Augusta, Wis., July 10; Wausau, Wis., July 19; Nadeau, Mich., July 18; and Conner, Pa., July 21.

GENERAL NOTES.

COÖPERATIVE WORK AGAINST INSECTS.

The *American Cultivator* for May 26, 1894, tells an interesting story about a recent move undertaken by the Genesee Valley Forestry Association. It seems that the Association a year ago offered prizes to the school children who should gather the largest number of cocoons of an insect which is somewhat indefinitely described as "the caterpillar which infests fruit and forest trees"—probably Clisiocampa. The three children gathering the largest number were to receive $5 each; the next three, $3; and the next three, $2 each. The highest prize was won by a boy who gathered 44,000 cocoons. Last winter the Association extended its offer, with the most amazing results. Clubs were formed, and it is doubtful whether any tree in the neighborhood remained unvisited and unexamined. One boy gathered 951,871 cocoons; another, 437,258; a third, 123,666; and a fourth, 88,238. Could more good have been accomplished in any other way by the same expenditure of money?

LEGAL ASPECTS OF FUMIGATION IN CALIFORNIA.

The Santa Ana (Cal.) *Weekly Blade* for June 9, 1894, reports that the Horticultural Commissioners of Orange County have filed liens upon the real estate of five fruit-growers in that county to cover the expense of fumigating their orchards, as required by law. The liens range from $117.05 to $285.30 in amount, but the item does not state what provision is made for collecting the money.

1894a

NOTES FROM ILLINOIS.

Chinch bugs are much more abundant here than usual. They are to be found in such numbers in grass and grain fields that a very serious chinch-bug outbreak is apparent.

Cutworms were not as common as usual during the early spring, but are now to be found in fair abundance. The Army Worm (*Leucania unipuncta*) has commenced to deposit eggs.

Aphis mali does not occur in usual numbers. During the warm weather before the middle of March, most of the eggs of this species hatched, and the cold weather in the last of March killed thousands of young Aphides; in fact, it was impossible to find any living specimens, although dead ones in great numbers clung to the apple twigs. Later

the remainder of the eggs hatched, and at this time (May 12) the winged pseudogynes are giving birth to young on the apple leaves, and also on the roots of some grasses, e. g., Timothy (*Phleum pratense*).

Empoasca mali is present in considerable numbers on apple trees and other plants. Adults were first observed in the orchard of the University of Illinois, May 7. Now larvæ, nymphæ, and adults are very common.

Teras minuta is at present the most destructive insect affecting young apple trees here. The larvæ are almost, or in many cases quite, full grown. Nurserymen are both spraying and picking by hand.

The moth of the Apple-leaf Skeletonizer (*Pempelia hammondi*) has just emerged (May 12) in my breeding cages. This rivals the foregoing species in the amount of damage to apple trees in this State.

The Apple Ornix (*Ornix geminatella*) is sufficiently abundant to make its presence quite objectionable in orchards. The adult moth was first captured March 31.

Eggs of a mealy bug (Dactylopius) have been found during the past winter and spring in great abundance in the culms of Timothy and straws of the small grains. The young mealy bugs commenced to hatch May 4. [H. A. SURFACE, *Champaign, Ill.*]

ANOTHER TRIAL WITH ENGLISH HESSIAN-FLY PARASITES.

During the month of May Mr. Fred. Enock, of London, England, sent to this office a box of puparia of the Hessian Fly infested by *Entedon epigonus* (*Semiotellus nigripes* Lind.). The parasites were already issuing from the puparia, and they were therefore sent to the most convenient of the suitable places, namely, Fredericktown, Md., and were liberated in a wheat field on the farm of Mr. G. Morgan Eldredge, of Philadelphia.

PROVANCHER'S ICHNEUMONIDÆ.

Prof. G. C. Davis, of the Michigan Agricultural College, has just published in the Proceedings of the Academy of Natural Sciences of Philadelphia, pages 184–190 of the volume for 1894, a paper entitled "Some Notes from a Study of the Provancher Collection of Ichneumonidæ." The species which Mr. Davis found in the collection (which as a whole is located in three rooms of the Parliament Building at Quebec, having been purchased by the Province) were carefully studied by him, and his comments are published in the shape of a synonymical list. Many of the types were not seen, but there is sufficient information in the paper to well justify its publication. Provancher worked so entirely alone that many of his numerous species will be found to be synonyms, and it is very gratifying to know that the collection has been placed in so accessible a location as Quebec, and in the hands of so careful a curator as Mr. Saussure. The collection was offered to the National Museum at Washington, but funds were lacking for its purchase.

CUTWORMS AND THEIR HYMENOPTEROUS ENEMIES.

We have lately received from Mr. I. W. La Munyon, of the Colorado Weather Service, specimens of a digger-wasp, *Ammophila luctuosa* Sm., and an Ichneumonid, *Cryptus robustus* Cr., with interesting notes on their habits. The digger-wasp, like other species of the genus Ammophila, provisions its nest with caterpillars. The species in question, according to Mr. La Munyon, preys upon certain cutworms, which he states are very destructive to crops in his vicinity. The wasp was observed to dig up the cutworms, sting them, dig a new hole in the earth, and then bury them after depositing eggs upon them. An individual was noticed July 8 selecting a place to dig for a cutworm. It rested prostrate on the ground with antennæ outstretched, also touching the ground, occasionally circling about in a space of about 6 inches diameter, and after selecting the proper spot soon unearthed the cutworm.

The Ichneumonid also digs after the cutworms and deposits eggs upon them. This species will dig down about 2 inches, remain for some time at the bottom of the hole, apparently listening, when suddenly it again begins to dig, perhaps in a new direction, and soon finds its victim.

The sting of the wasp paralyzes the cutworm, and the wasp thereafter fills up the hole, hiding it carefully from view by restoring the earth to its natural condition, sometimes carrying stones and depositing them on the spot where the hole was, as observed by Mr. Th. Pergande and recorded in the Proceedings of the Entomological Society of Washington (vol. II, p. 256). The sting of the Cryptus, however, does not paralyze the cutworm, but the eggs which are inserted hatch into larvæ, which do not interfere for a time with the feeding habits of the cutworm. The Cryptus makes no attempt to fill up its hole.

BRAN AND PARIS GREEN FOR CUTWORMS.

Mr. R. C. Allen, of Bonita, San Diego County, Cal., publishes in the *California Fruit Grower*, under date of May 26, an interesting account of his success in the use of bran and Paris green against cutworms, which infested his vineyard. He mixed three pounds of Paris green to a sack of rye bran, stirred it thoroughly, moistened it, and then threw a handful or so of the mixture about the trunk of each vine. He says that there were many cutworms in his vineyard, and that last year his vines were leafless from their work. This year ten pounds of Paris green and a few sacks of bran completely destroyed the worms in a vineyard of thirty acres before any damage was done.

THE EMERGENCE OF PRONUBA FROM YUCCA CAPSULES.

Mr. J. C. Whitten has just sent us a paper under this caption, reprinted from the Fifth Annual Report of the Missouri Botanical Gardens, in which he announces that during August, of 1893, he was

able to follow the larvæ of *Pronuba yuccasella* in their journey from the capsules of *Yucca filamentosa* to the ground. The observation is noteworthy for the reason that this point has been up to the present time the only break in the life-history of Pronuba. Mr. Whitten found that, as had been anticipated by Prof. Riley, the larvæ leave the capsules during rainy weather, when the ground is softened and consequently easily penetrable. They do this, however, either during the daytime or at night, and not exclusively during the end of the night, as had been predicted by Riley. The larva issues from the capsule and drops quickly down at the end of a silken thread.

NOTES ON THE EUROPEAN LEOPARD MOTH.

Mr. Henry Herpers, a member of the Entomological Society of Newark, N. J., sends samples of the work of *Zeuzera pyrina* cut from a branch of *Acer dasycarpum* which was blown from the tree by an April storm. In an accompanying letter he directs attention to a number of interesting facts in the economy of the species. In all the twigs sent the larva had been working upward instead of the reverse, as mentioned by Machesney (*Ent. Am.*, vol. VI, p. 36). One of these, measuring but three-eighths of an inch in diameter, and within which it would seem impossible for the larva to complete its growth, appears to indicate that the larva after attaining a certain size must forsake its original habitation for a larger branch or perish.

He mentions also some facts that have already been noted by others, viz, the excessive superabundance of males and the attractiveness of electric light for the species. This insect, it will be remembered, was not known with certainty to have established itself in this country until 1887. During the following year Mr. Herpers thinks that of several hundred taken about Newark not a half dozen were females. In 1892, however, he noticed in one evening several scores of the females that had been crushed under the electric lights by passing pedestrians, the large pink egg-masses furnishing proof of the sex.

A LEAF-CHAFER ATTACKING PETUNIAS.

Mr. J. S. Strayer, of Port Republic, Va., an old correspondent of the Division, sends specimens of the Scarabæid, *Anomala undulata* Mels. (*varians* Fab.), with the information that they damage a number of cultivated flowers, particularly petunias. He writes, under date of June 23, 1894, that they eat into the flower to the heart, burying themselves nearly out of sight. They work rapidly, and it requires only a short time to riddle and destroy a flower. On some blossoms as many as twenty beetles were found. They appeared to show a marked preference for white flowers.

This species is known to be somewhat omnivorous in the adult state, and an account of damage to wheat is given in the report of the Ento-

mologist for the year 1884 (p. 412). The wheat crop of one farmer in Marion County, Kans., was reported that year to have been damaged to the extent of a thousand bushels.

A SEVERE CONORHINUS BITE.

Mr. J. B. Lembert, of California, with whom we have had considerable correspondence, particularly on the subject of the bite of the Cone-nose, writes us, under date of May 7, that upon the 5th of May a Conorhinus stung him at 2 o'clock in the morning, while in bed, upon the middle toe of the left foot. Mr. Lembert used saliva to ease the itching sensation, but this continued and finally spread over the toes, up the instep, legs, thighs, and loins, where large, flat blotches were raised. It finally extended further up the hands and arms; his lips swelled; his neck, nose, and eyebrows itched and swelled on scratching, and his scalp was a mass of lumps from the same cause. He stood this as long as he could and then went out to a water ditch and soaped and bathed his body in cold, melted snow-water, and applied bacon grease thoroughly. A little later he became sick at his stomach and took a strong cup of coffee. About six o'clock in the morning the itching abated, but the swelling remained on his hand and foot until the next day. In a later letter Mr. Lembert states that he has noticed that the Conorhinus is attracted by carrion, and he explains a large number of the poisonous effects of the bite by the mechanical conveyance of putrid animal matter to the wound made by the beak of the insect.

A NEW REMEDY FOR CHERMES.

A correspondent from Philadelphia writes us that having a fine tree of hemlock-spruce badly affected by *Chermes pinicorticis*, he was advised to dig a trench around the tree and put in chlorate of potassium as a remedy for the insect. He followed the advice, and also used nitrate of soda in the same way. The result was that while the tree grew a little greener in the winter time, the summer saw it gradually dying. This remedy is new to us. It seems to be on a par with boring auger holes into the trunk and filling them with sulphur!

CICADA EGGS.

We have had several reports from the South and elsewhere that the old supposition as to eggs of the "Seventeen-year Locust" being poisonous is again revived. A correspondent in Mississippi writes that the woods are full of blackberries, but the negroes absolutely refuse to gather them because, as they express it, "Them singin' locusses done pizened 'em with their aigs." A newspaper item states that a little girl living near Jackson, Miss., was poisoned by eating blackberries on which the seventeen-year locust had deposited its eggs. It naively adds, however, that "she will live."

KEROSENE EMULSION AS A DETERRENT AGAINST GRASSHOPPERS.

Grasshoppers were very abundant in central Texas during 1893. An interesting experiment was tried in an orchard by the staff of the State Experiment Station. A thorough spraying of the orchard trees resulted in the apparent destruction of none of the grasshoppers, but they soon ceased eating, left the orchard, and did not return to it for days.

OBITUARY.

We have learned since the publication of the last number of INSECT LIFE of the death of two well-known writers on North American insects, both of whom will be greatly missed by entomologists. One, Mrs. Julia P. Ballard, wrote mainly on the popular side of entomology, and her recent book "Among the Moths and Butterflies" combined the most charming style of diction with the strictness of science as to its facts. Many of our readers may be interested to learn, as we were, that Prof. Harlan H. Ballard, the founder of the Agassiz Society, is her son. Her surviving husband, Addison Ballard, is professor in the University of the City of New York.

The other death, which we greatly regret to have to record, is that of Mr. Edward Norton, a well-known writer on the Hymenoptera. Mr. Norton's papers were devoted mainly to the Tenthredinidæ, although he catalogued the species Ophion, Anomalon, and Campoplex, and also published two careful papers upon ants. In addition to this his monograph of the Chrysididæ of North America formed a basis for our study of this group in this country. Mr. Norton had not published any important papers on entomology for the past fifteen years.

ENTOMOLOGICAL SOCIETY OF WASHINGTON.

February 28, 1894.—This meeting was devoted to an address by Prof. E. B. Poulton, of Oxford University, England, on the subject of colors in insects, the object of the paper being to introduce a series of illustrations of recent work upon the uses of colors to insects in the struggle for existence.

April 5, 1894.—A paper on the structure of the ovipositor in the Hymenoptera, by Mr. Marlatt, was read by the Corresponding Secretary. Mr. Heidemann exhibited specimens of a number of rare and interesting Hemiptera. Mr. Schwarz offered for publication a description of the Scolytid infesting pine cones. He also gave short notes on the distribution and probable origin of Fuller's Rose Beetle (*Aramigus fulleri*), on the larval habits of the Dermestid (*Cryptorhopalum triste*), and on certain abnormal growths found on the bark of the Paper Mulberry, caused by the Scolytid borer (*Phlœotribus frontalis*). These remarks were accompanied by the exhibition of specimens. Mr. Schwarz showed specimens of small insects mounted on cardboard triangles in such a manner as to leave the sternum free for examination and study. He also exhibited specimens of a Staphylinid (*Oxyporus 5-punctatus*), and called attention to the remarkable secondary sexual characters present in the male.

May 3, 1894.—Rev. P. Jerome Smith and Mr. David M. Little were elected corresponding members. Prof. Riley presented some notes on Margarodes or Ground

Pearls, and exhibited necklaces made of the shells of these insects. Mr. Hubbard also made some remarks on this subject. Mr. Hopkins read a paper entitled "Notes on the Habits of certain Mycetophilids," with descriptions of *Epidapus scabies* n. sp., one of several Dipterous insects, the larvæ of which are directly or indirectly the cause of the so-called potato scab. Prof. Riley exhibited a series of West Indian Termites, comprising *Eutermes morio* and *E. rippertii.* Mr. Benton exhibited nests and living specimens of a bee of the genus Melipona.

June 7, 1894.—President Ashmead congratulated the society upon the attainment of its one hundredth meeting and upon its prosperous career and prospects. The Recording Secretary read a review of the work of the society during the past ten years. Mr. Pergande presented additional observations upon the habits of *Ammophila gryphus* for publication. Mr. Benton read a paper entitled "Observations on the Mating of Queens of *Apis mellifica,*" recording two instances of the queen mating the second time. Mr. Chittenden presented for publication some biological notes on certain Coleoptera. Mr. Schwarz read a paper on the composition and extent of the Coleopterous fauna of Alaska. He also read some notes on the West Indian Sugar-cane Borer (*Xyleborus perforans*), and showed the difficulty of determining whether this insect really occurs in the United States. Mr. Heidemann exhibited certain rare Pentatomids, and Prof. Riley announced the rearing of perfect females of Margarodes. He showed that Margarodes and Porphyrophora are synonymous.

L. O. Howard,
Recording Secretary.

ERRATA.

Page 41, under note "Army Worm in New Mexico," for "*Lecanium*" read *Leucania.*

Page 51, line 3, "*Ichnaspis piliformis*" read *Ischnaspis filiformis;* line 12, for "Terminalis" read Terminalia.

Page 55, fourth line from bottom, for "*Euplectus*" read *Euplectrus.*

Page 74, about middle of third paragraph, for "Deidrocephala" read Diedrocephala.

Page 120, line 6, *delete* "London purple and."

Page 154, tenth line of second paragraph, for "congenor" read congener.

Page 155, under legend of Fig. 5, for "lava" read larva.

Page 185, third line from bottom of third paragraph, for "agriculturist" read apiculturist.

Page 186, line 6, for "reach" read reached.

Page 189, second line of second paragraph, for "*Chœtocnema*" read *Chætocnema.*

Page 193, third line of fourth paragraph, for "*bivittata*" read *bivittatus;* fourth line of fourth paragraph, for "unusally" read unusually.

Page 197, last line, for "*boisduvallii*" read *boisduvalii.*

Page 208, third line from bottom of first note, for "*Aspidiotus*" (repeated) read *Diaspis.*

Pape 210, third line of second note, for "raspberry" read gooseberry.

Page 216, eleventh line from bottom, for "ommitted" read omitted.

Page 273, about middle of second paragraph, for "*Præpodes*" read *Prepodes.*

Page 278, lines 1 and 2, for "Lownes's" read Lowne's.

Page 280, fourth line of second note, for "Hagan" read Hagen.

Page 282, third line from bottom, for "Diaprinne" read Diapriinæ.

INDEX TO ILLUSTRATIONS.

AUTHORS' INDEX.

PLANT INDEX.

GENERAL INDEX.

ABBREVIATIONS USED: Art., article; descr., description; m. or men., mention; n. g. or gen. nov., new genus; n. sp., new species; ref., reference; rem., remarks; rept., report; rev., review; sp., species.
Notices of agricultural experiment station publications are entered under "Experiment Stations."

B.

T.

U.

V.

W.

X.

Y.

Z.

o